The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Vol. XXV, No. 1 CHICAGO January 14, 1922

EDITORIAL DEPARTMENT—

Nathan C. Rockwood, Editor
Chas. A. Breskin,
H. E. Hopkins,
Associate Editors

ADVERTISING STAFF—

Charles H. Fuller, Eastern Manager,
101 West 41st Street, New York City

A. S. Barnett,
Western Representative

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ROCK PRODUCTS—

Geo. P. Miller, Manager
E. M. Gibson, Assistant Manager

Published every other Saturday by

TRADEPRESS PUBLISHING CORP.
542 South Dearborn Street, Chicago, Ill.

W. D. Callender, President.
N. C. Rockwood, Vice-President.
Geo. P. Miller, Treasurer.
C. O. Nelson, Secretary.

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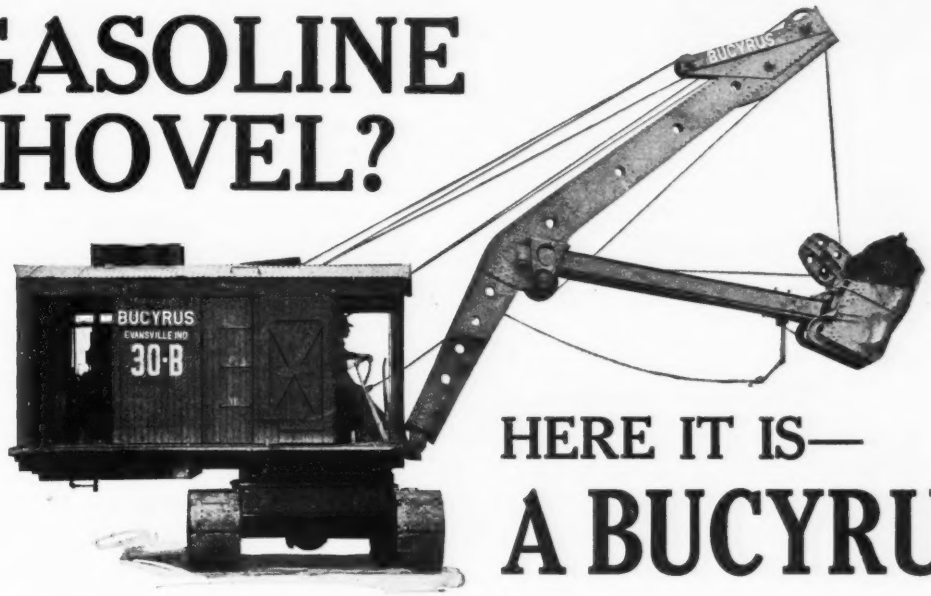
ARE YOU INTERESTED IN A GASOLINE SHOVEL?



HERE IT IS— A BUCYRUS

A 1-Yd. shovel operated by a single, rugged, slow speed gasoline engine.

A positive, powerful thrust with no engines, motors, chains, belts, gears, clutches or complicated shafting on boom.

Digging power actually greater than a steam shovel of same size.

Same digging characteristics as a steam shovel—for instance, you can shake the dipper to relieve it of sticky material.

Greater tractive power than a steam shovel of same size.

Far simpler in design and easier to maintain than any other types of electric or gasoline shovels.

The Bucyrus 30-B gasoline shovel will handle 20% more material per gallon of gasoline than any other type of shovel whose power is obtained from a gasoline engine.

Convertible for work as a dragline excavator, clamshell excavator or crane.

It Will Pay You to Investigate

Bucyrus Company

South Milwaukee, Wisconsin

BRANCH OFFICES:

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Chicago
Portland, Ore.
San Francisco
Denver
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393

Cut Out and Mail This Coupon

BUCYRUS COMPANY
South Milwaukee, Wisconsin

Please send me your bulletin F-301-P, describing your new 30-B gasoline shovel.

My work is.....

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Signed.....

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NEW STYLE "N"
GYRATORY CRUSHER

The Following Advantages Should Be Considered

1—Less Friction than so-called low down or short frame crushers.

2—Horse power reduced to a minimum, through the use of cut steel gears, and forced lubrication.

3—Greater discharge opening and stronger construction.

4—Machine can be made either regular drive, right hand or left hand by simply locating the bearing in the proper opening.

5—The lubrication is of the simplest and the most positive design.

6—Larger diameter shaft with 50% greater strength.

7—The reduction of installation height of 16% of the present gyratory crushers.

8—Improved hopper design.

9—Dust proof.

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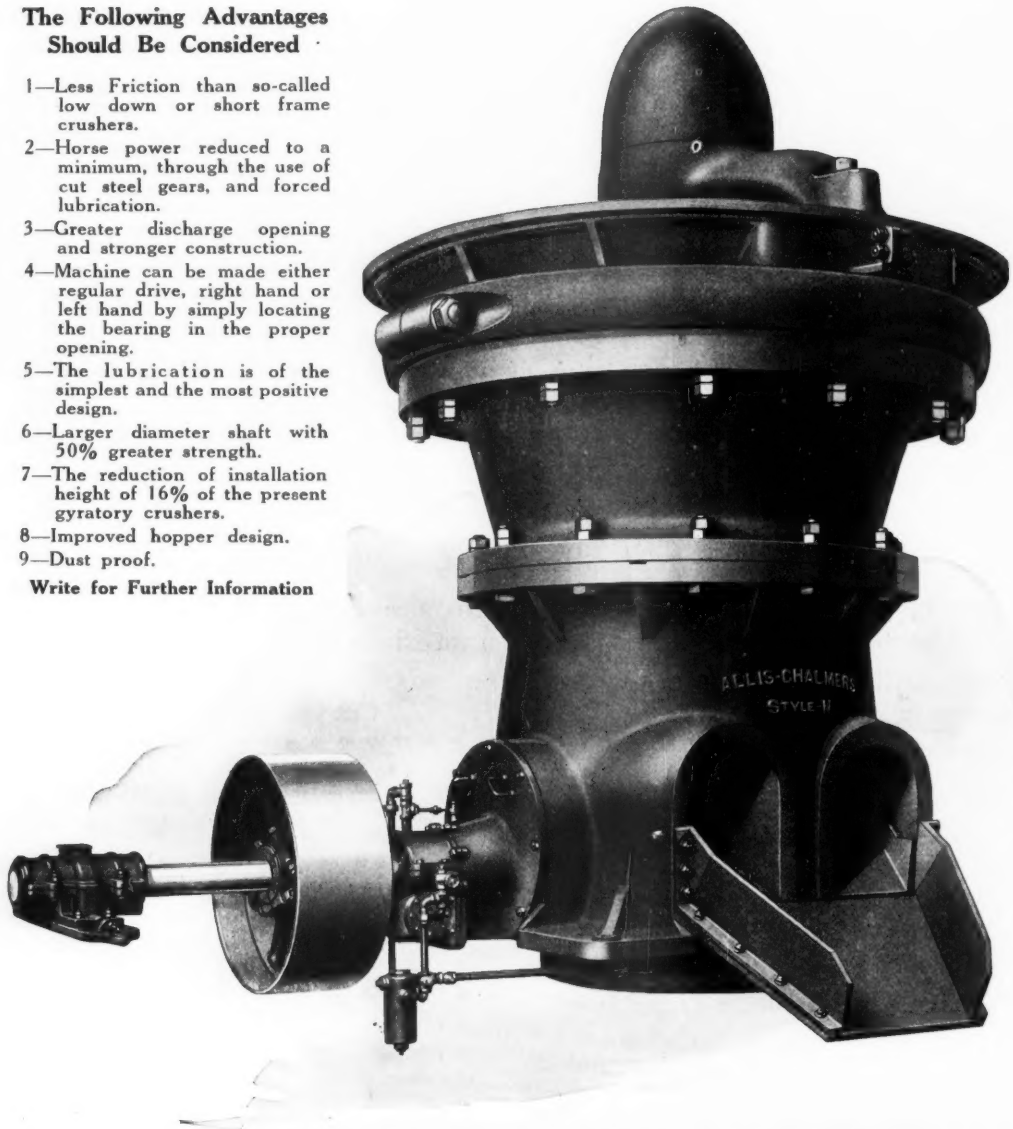

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.

"Jackhammers"

The most important factor when considering the purchase of a Rock Drill is *durability*. The drill must "stay on the job."

Many times the initial cost of the drill may easily be spent in lost running time and cost of taking it to and from the repair shop.

"Jackhamers" are known for their durability, which is a direct result of their proven design and all steel drop forged construction.

Their simplicity minimizes the number of wearing parts. It also lets the operator become familiar with "what is going on inside"—and the operator who knows will take pride in correct operation.

"Jackhamers" lighten the day's work yet drill more rock. They make efficient, satisfied workmen.

"Jackhamers" are made in many sizes and types—one for each kind of rock drilling work.

Bulletin 4046 describes "Jackhamers" completely. Request your copy now.

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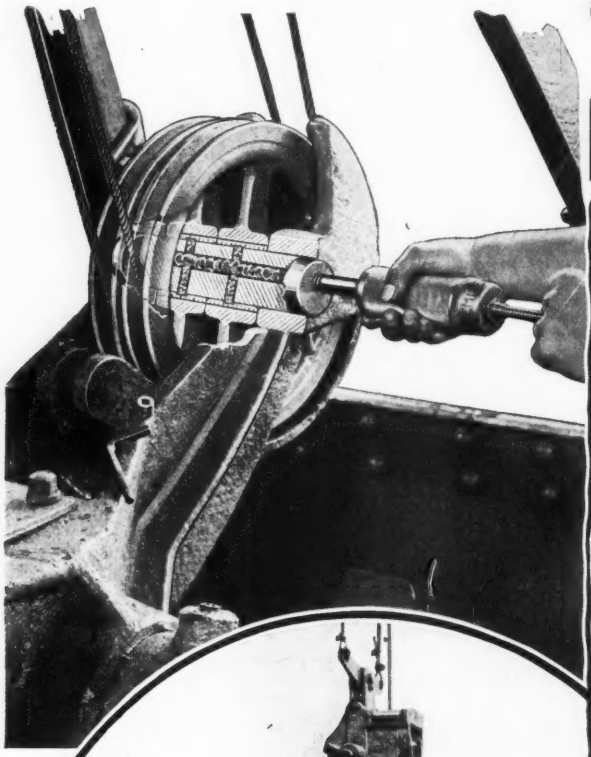
11 Broadway, New York
Offices Everywhere

246-JD

Ingersoll-Rand

LUBRICATION

determines the life of a BUCKET



Thorough Lubrication Easily Achieved in

BLAW-KNOX BUCKETS

We furnish a high-pressure grease gun to the operator of every Blaw-Knox Bucket—cavities are machined in bearing castings and pins (as illustrated) into which heavy grease is quickly forced.

Frequent greasing saves bearing wear and eliminates upkeep expense on sheaves and bushings.

Blaw-Knox Buckets are designed to stand up against hard service. The fewest possible moving parts—generous and practical provision to insure proper lubrication—bronze bushed sheaves—heavy corner bars forged from solid steel billets—heavy, reinforced scoops with strong rigid lips—rope leads straight with no reserve of S bends in the reeving.

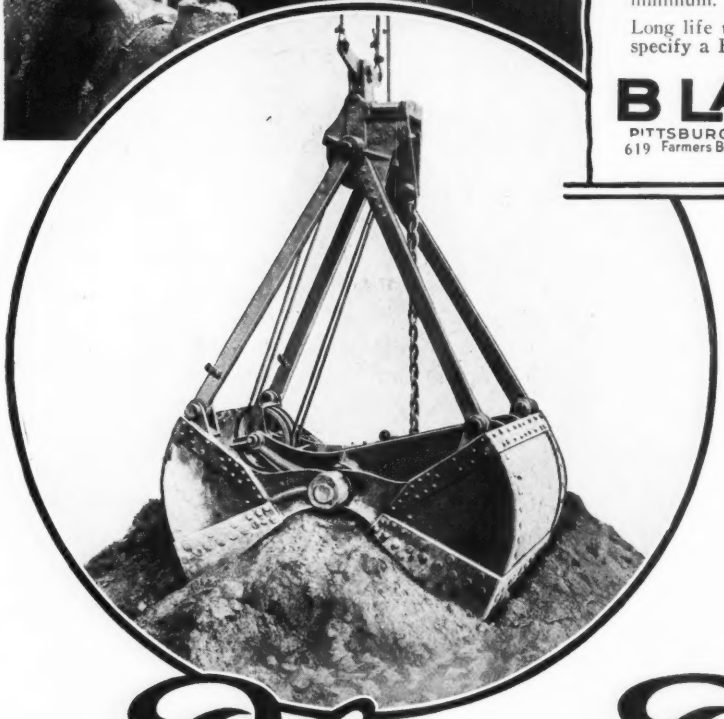
These features combine to eliminate service delays and upkeep expense and reduce rope wear to a minimum.

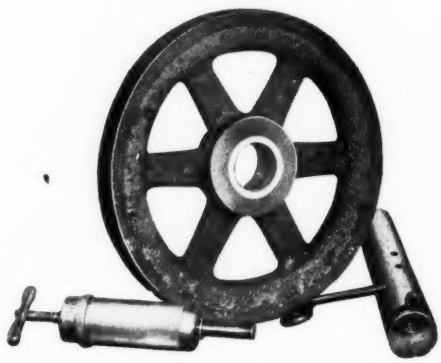
Long life under the most severe service is assured—specify a Blaw-Knox Bucket for your crane.

BLAW-KNOX COMPANY

PITTSBURGH, PA.
619 Farmers Bank Bldg.

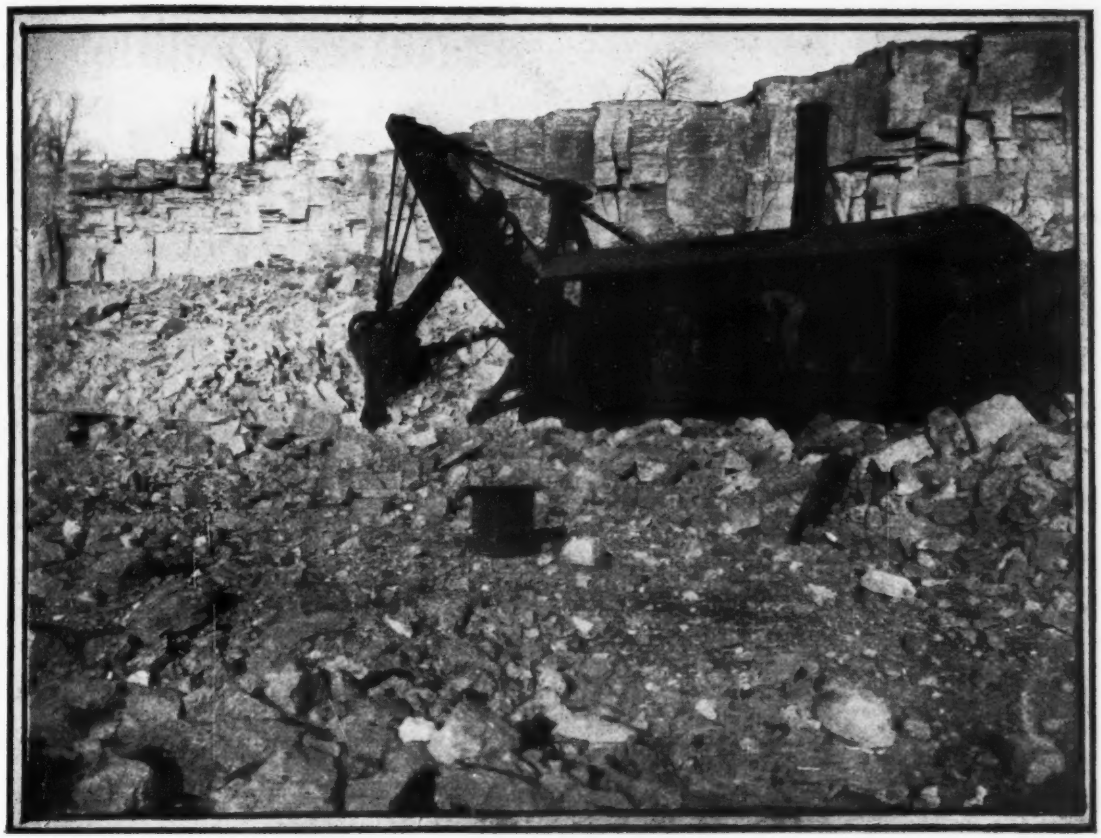
New York · Boston · Chicago · Detroit · Kansas City
Baltimore · Birmingham · San Francisco





As illustrated above—all sheaves are bronze bushed. Annular groove in bushing for proper grease distribution. Cavities machined into bearing pins through which heavy grease is forced by gun provided for the purpose.

Blaw Buckets



Keep those shovels busy!

Every hour that a shovel is loading it is earning.

Good explosives prepare the way and provide the shovel with constant work.

But not every good explosive meets every condition. There is a particular grade of Grasselli Explosive that is especially adapted to the conditions in your quarry.

Our practical service men will tell you just what grade that is, and he may be able to give you some other welcome information. Write the branch nearest you.

The Grasselli Powder Company

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Philadelphia, Pa.
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ESTABLISHED 1839 CHEMICALS ZINC GRASSELLI EXPLOSIVES DYESTUFFS

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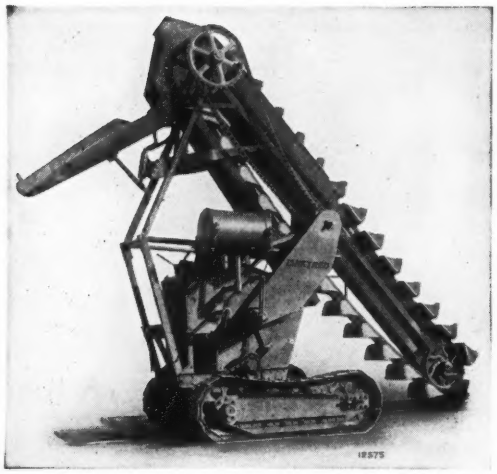
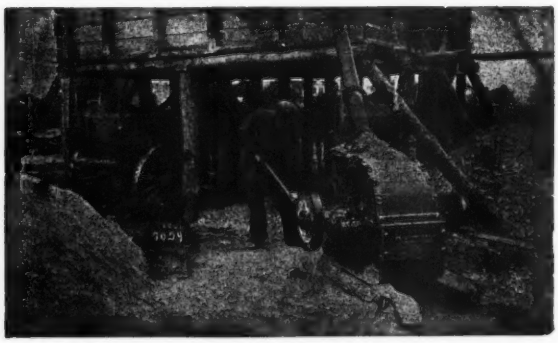
GRASSELLI EXPLOSIVES



Jeffrey TANKTRED Loader for handling Crushed Stone, Sand, Gravel, Coal, etc. Digs itself into pile under its own power. Capacity 1½ to 2 cubic yards per minute.

Type "G" Radial Type Loader—Digs 8 to 10 feet into the Storage pile. Will turn a complete circle with either drive wheel as a center. **Capacity 1½ to 2 cubic yards per minute.**



Type "A" Swing Hammer Pulverizer—In operation in Road Contractor's Plant.

Material Handling Cost Will Determining the Profits on Y

YOU are going to meet real competition this year, bidding will be spirited, and every dollar of expense you save means just that much more on the credit side of your ledger.

Jeffrey Machinery has been helping Contractors and others to keep down material handling costs for nearly half a century, and it will pay you to investigate the possible savings it can effect for you.

Our Engineers will be glad to give you the benefit of their long experience in solving all kinds of material handling problems, and aid you in the selection of the right equipment to meet your requirements.

You will need Jeffrey Machinery on your next contract, so write for Catalogs and Prices, at the same time giving us full particulars regarding your your local conditions.

THE JEFFREY MFG. CO.

New York Boston | Philadelphia Scranton | Chicago St. Louis | Buffalo Pittsburgh | Detroit Birmingham

JEFFREY

MATERIAL HANDLING MACHINERY

When writing advertisers please mention ROCK PRODUCTS

Be a Mighty Big Factor in our Road Building Contracts

Jeffrey Machinery for Road Contractors includes: TANKTRED and RADIAL type Self-Propelling Loaders for the handling of Crushed Stone, Sand, Gravel and other loose materials.

Portable Belt Conveyers in various lengths, and adjustable to various heights. Light, inexpensive outfits that quickly pay for themselves.

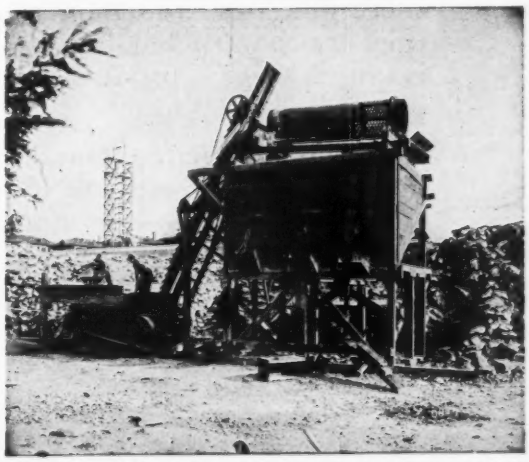
Continuous Bucket Elevators for the handling of Sand, Gravel, Crushed Stone, Coal, etc. 56 standard sizes of Elevators, ranging in capacity from 6 1/2 to 80 tons per hour with vertical lifts of from 10 to 75 feet.

Type "A" Swing Hammer Pulverizer for making sizes of Crushed Stone for building modern macadam roads; producing Road Top Dressing; Making Stone for Concrete, Finishing Stone, Fluxing Stone, Coating Finish, Ground Limestone for Fertilizer, etc.

Industrial Locomotives—Storage Battery and Trolley Types.

Portable Belt Conveyer—A light and inexpensive machine which meets the requirements of the small contractor, coal dealer or manufacturer

A Jeffrey Continuous Bucket Elevator, mounted on four-wheel traveling truck for loading from ground storage to bins.



Road Building Outfit—Jeffrey Continuous Bucket Elevator handling Crushed Stone from Crusher to Revolving Screen.

935 North Fourth Street **COLUMBUS, OHIO**

Cleveland Denver Dallas Middlesboro, Ky.
Charleston, W. Va. Los Angeles Milwaukee Montreal

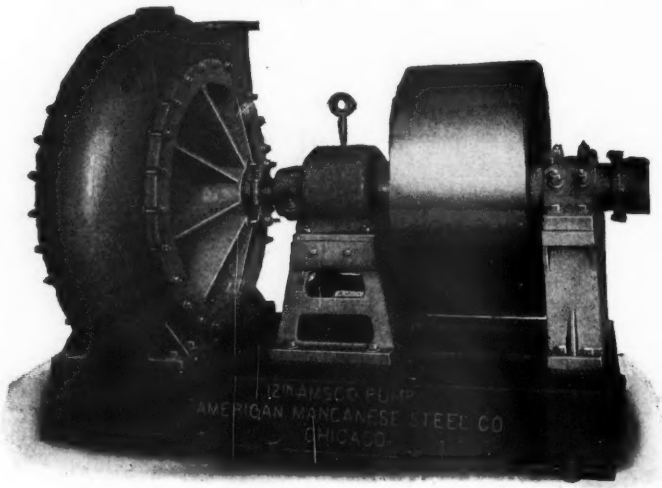
JEFFREY
MATERIAL HANDLING MACHINERY

When writing advertisers please mention ROCK PRODUCTS

AMSCO

MANGANESE STEEL PUMPS

Provide Service and Economy



WHEN AMSCO performance, or economy, or long life impresses you as extraordinary, remember the real source of these qualities is not alone in the Manganese Steel of which they are constructed, but is due in part to the fact that this pump is an AMSCO product—designed and built in the AMSCO plant.

If we have been able to make the AMSCO a better pump, and a better paying investment to producers—and many of them will tell you we have—our manufacturing facilities, and the care and skill with which these facilities are employed must share the honor.

AMSCO Pumps—Flap Valves—Pipe—Pipe Flanges—Elbows
Repair Wearing Parts for Pumps—Agitators—Cutters

Your inquiries will receive the fullest co-operation of our Pump Department Engineering Services. Let us tell you why the AMSCO is the most desirable pump for your work.

We are now prepared to furnish rolled and forged manganese steel products and solicit your inquiries.

AMERICAN MANGANESE STEEL COMPANY

General Sales Offices, Chicago Heights, Ill.

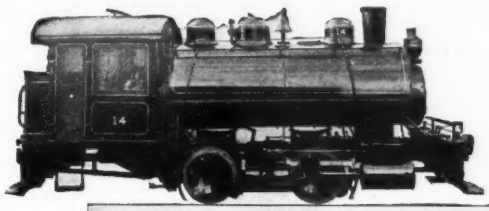
Plants: Chicago Heights, Ill. New Castle, Delaware Oakland, California

Taking the Loose Motion Out of Contract Work—

WEATHER conditions have a lot to do with contract profits, but the contractor that handled the job illustrated refused to let them beat him out.

The conditions were: heavy grades, one about 12 per cent; sharp curves, one limited the trains to two loaded cars; and working day shifts only, with half the time lost due to rain and moving up delays.

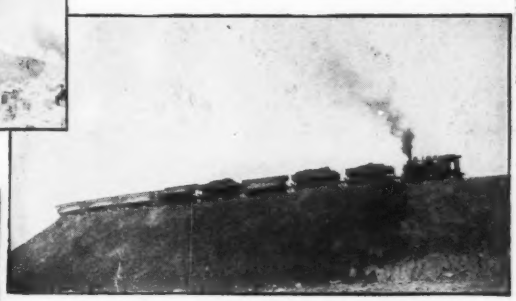
With these conditions against him, but with four 22-ton VULCAN Locomotives and thirty-three Western 8-yard air dump cars, 56,000 cubic yards were moved about 2000 feet in a single month. Such records do not permit of locomotive delays.



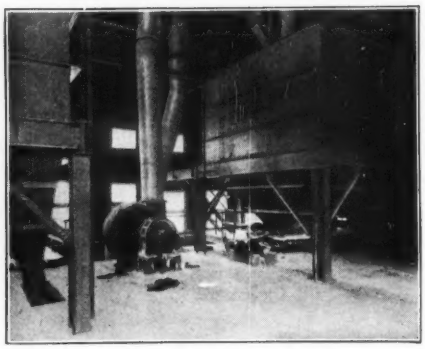
VULCAN IRON WORKS

Established 1849

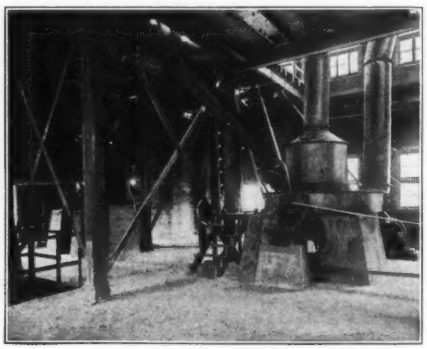
1753 Main Street **Wilkes-Barre, Pa.**



VULCAN LOCOMOTIVES



Raymond Special Exhaust Fan Direct Connected to Motor



Raymond Roller Mill with Gypsum Dryer in Background at Left

Raymond Roller Mills Grind Gypsum in More Than 35 Plants and Grind it at a Low Cost Per Ton

Gypsum, like a great many other materials, varies in its grinding characteristics. Some is hard, or rather, contains hard impurities, and some is soft and easy to grind. The capacity produced by any grinding mill will depend upon the character of the Gypsum. Therefore, no true comparisons can be made between grinding machines unless they are working on the same Gypsum from the same mine and under the same conditions.

Raymond Roller Mills give varying capacities from four tons per hour up to ten tons per hour and grind either coarse or fine, depending upon requirements. The usual fineness produced is 95% passing a 100 mesh test sieve.

The fineness produced by Raymond Roller Mills makes for quick calcining, reducing power required for this part of the process, and giving a light, fluffy product, which will keep longer in storage.

If you grind any material to a powder, it will be well worth your time to get a proposition on a Raymond Mill for that purpose.

Raymond Bros. Impact Pulverizer Co.

1301 North Branch Street Chicago, Ill.

Western Office: 201 Boston Bldg., Denver, Colo.
Eastern Office: 50 Church St., New York City

A Two-Fold Drill Investment

PRACTICALLY all of the early installations of Cyclone Big Blast Hole Drills were made on the basis of guaranteed results—by this we mean guaranteed per ton cost of material drilled, blasted and laid down on the quarry floor.

As pioneers, Cyclone Drills not only had to overcome the existing prejudice in favor of piston drills and the benching method of quarry operation, but it was also found necessary to checkmate the unfavorable performance of some so called big blast hole drills, which were not blast hole drills but well drills and not heavy enough, strong enough or mechanically suited to the work.

The outgrowth of this was the development of a two sided organization whose functions were, first. the manufacture of drilling machines and tools exactly suited to the conditions; second, the gathering together and the training of a service corps—men who could handle these machines in all kinds of rock, not only the drilling end but also take care of the proper spacing, loading and blasting of the holes whenever necessary.

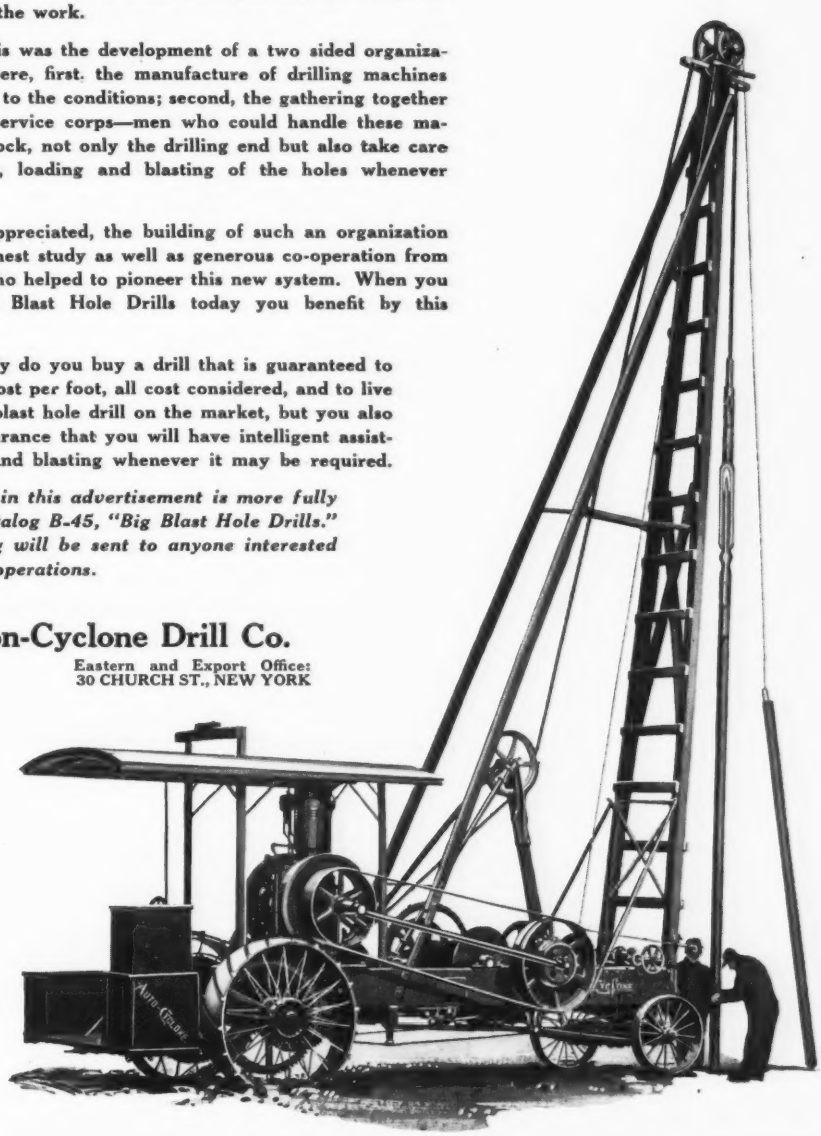
As will be readily appreciated, the building of such an organization has taken time and earnest study as well as generous co-operation from the quarry operators who helped to pioneer this new system. When you invest in Cyclone Big Blast Hole Drills today you benefit by this experience.

Furthermore, not only do you buy a drill that is guaranteed to drill more hole at less cost per foot, all cost considered, and to live longer than any other blast hole drill on the market, but you also acquire with it the assurance that you will have intelligent assistance on your drilling and blasting whenever it may be required.

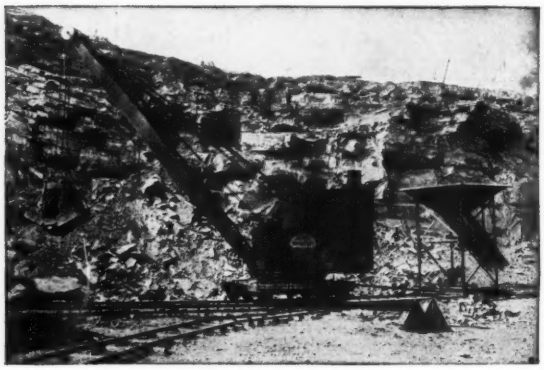
What we have said in this advertisement is more fully covered in our new catalog B-45, "Big Blast Hole Drills." A copy of this catalog will be sent to anyone interested or engaged in quarry operations.

The Sanderson-Cyclone Drill Co.
Orrville, Ohio

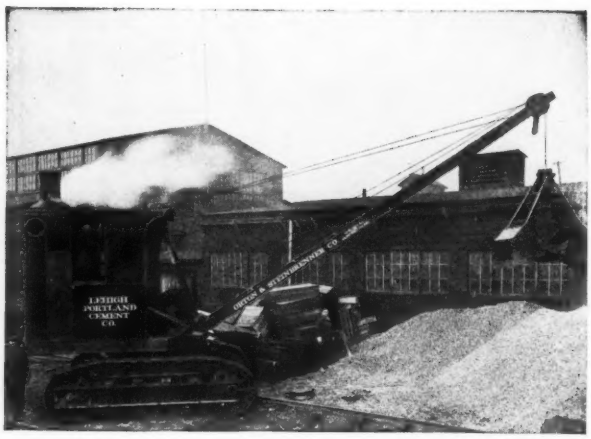
Eastern and Export Office:
30 CHURCH ST., NEW YORK



7 Ton Crawling Tread Crane Handling Fall Block



18 Ton Broad Gauge Crane



7 Ton Crawling Tread Crane Handling Clam-Shell Bucket

O. S. Dependable

Locomotive Cranes
Clam Shell and
Orange Peel Buckets

O. S. Dependable Locomotive Cranes reduce the expense of handling materials, and increase profits and output wherever installed.

They are manufactured in sizes ranging from 7 to 60 tons capacity. 7 and 12 ton sizes may be mounted upon either railroad wheels, crawling treads or traction wheels, and equipped to handle clam-shell, orange-peel or scraper type bucket and electro magnet.

All our material handling equipment is unsurpassed for simplicity and accessibility, and the quality of the workmanship and material insures rare economy of performance, and service durability.

Send for our catalogs completely illustrating our complete line of products. They are full of actual photographs made on the job, and tell the story of satisfied users

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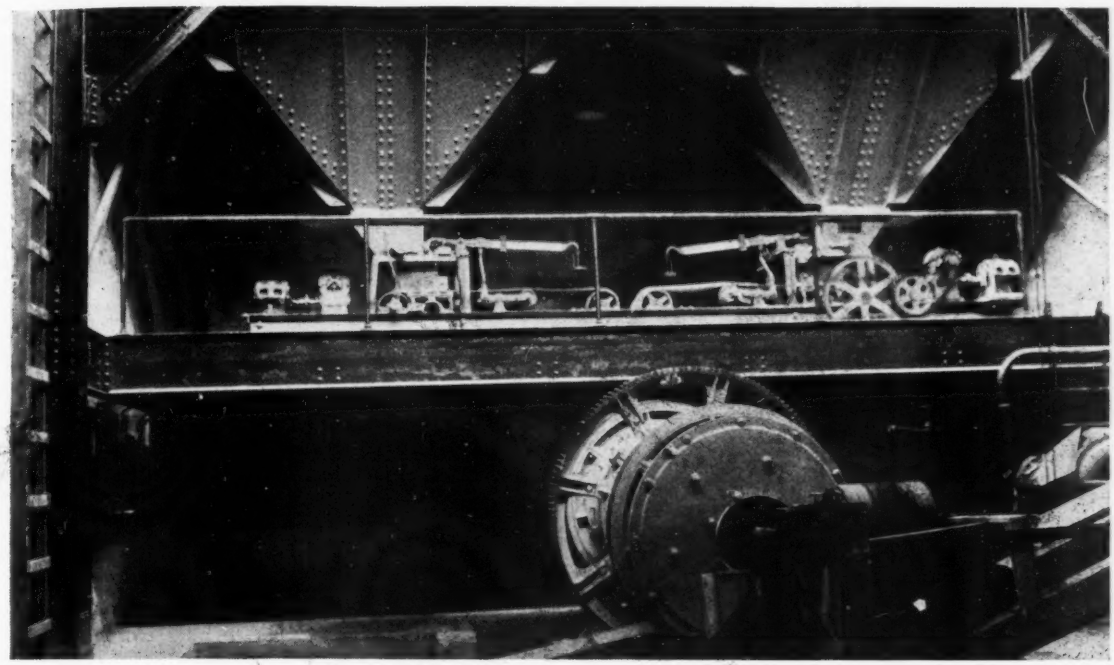
Catalog No. 21
Standard Gauge Railroad Cranes
Catalog No. 18
Clam-Shell and Orange-Peel Buckets
Catalog No. 17
Coal Crushers
Catalog No. 19

ORTON & STEINBRENNER CO.
Main Offices—Chicago, Ill.
Factory—Huntington, Ind.



SCHAFFER Poidometers

THE cement that is made where Schaffer Poidometers assist the chemist, invariably pass the most severe tests. With minute exactness the chemist can regulate the proportions of raw materials to compensate for their varying composition. This variation can be made by simply regulating a weight arm.

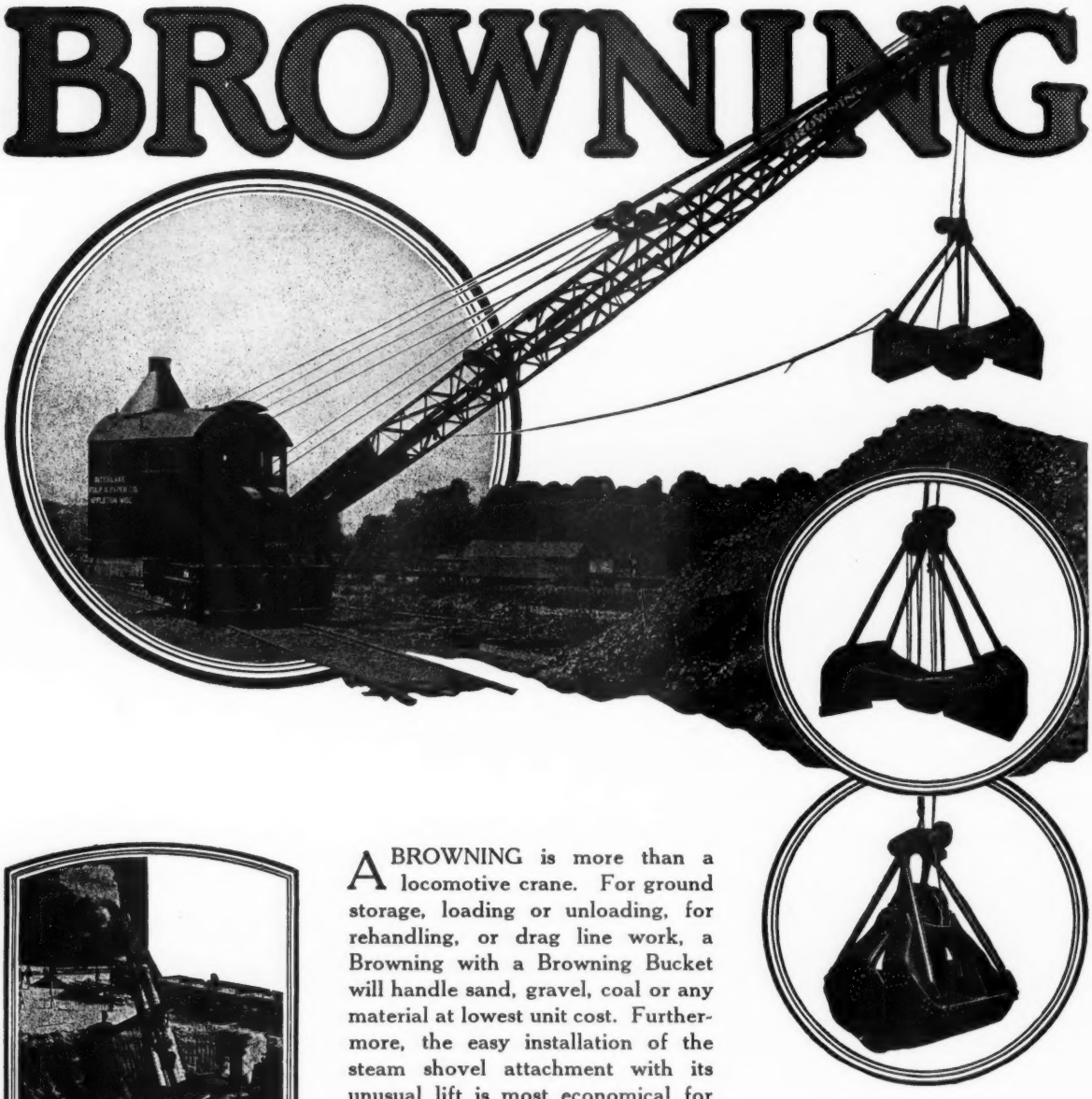
The Poidometer is a very simple machine for continuously, automatically and accurately weighing and regulating the supply of material as it comes from the bins or bunkers. It is also made with an attachment for delivering a predetermined proportion of water to the amount of solids or for delivering solids in proportion to liquids.

Another function of the Poidometer is that it keeps track of production and wastage in many ways. It checks up and saves money throughout the plant.

Send for bulletin No. 5. Learn where and how you can use the Poidometer.

SCHAFFER ENGINEERING & EQUIPMENT CO.
2828 Smallman Street PITTSBURGH, PENNSYLVANIA

BROWNING



A BROWNING is more than a locomotive crane. For ground storage, loading or unloading, for rehandling, or drag line work, a Browning with a Browning Bucket will handle sand, gravel, coal or any material at lowest unit cost. Furthermore, the easy installation of the steam shovel attachment with its unusual lift is most economical for deep excavations. And, in spare moments, a Browning is a time-saving switch engine.

The overhead on Brownings is notably low. Write us describing your operations and we will submit an accurate report on the savings a Browning will accomplish.

THE BROWNING COMPANY
CLEVELAND, OHIO

SALES OFFICES:

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LOCOMOTIVE CRANES AND BUCKETS

Are You Tied Down to High Production Costs?

Automatic Aerial Tramway

Now is the time to prepare for the new business conditions, the keen competition you will encounter with the opening of the 1922 season.

Producers everywhere are going over their plants installing the machinery that will economize on production, and a goodly portion of these live, wide awake managers have contracted for the Automatic Aerial Tramway, the equipment that will move material at the lowest per ton cost—

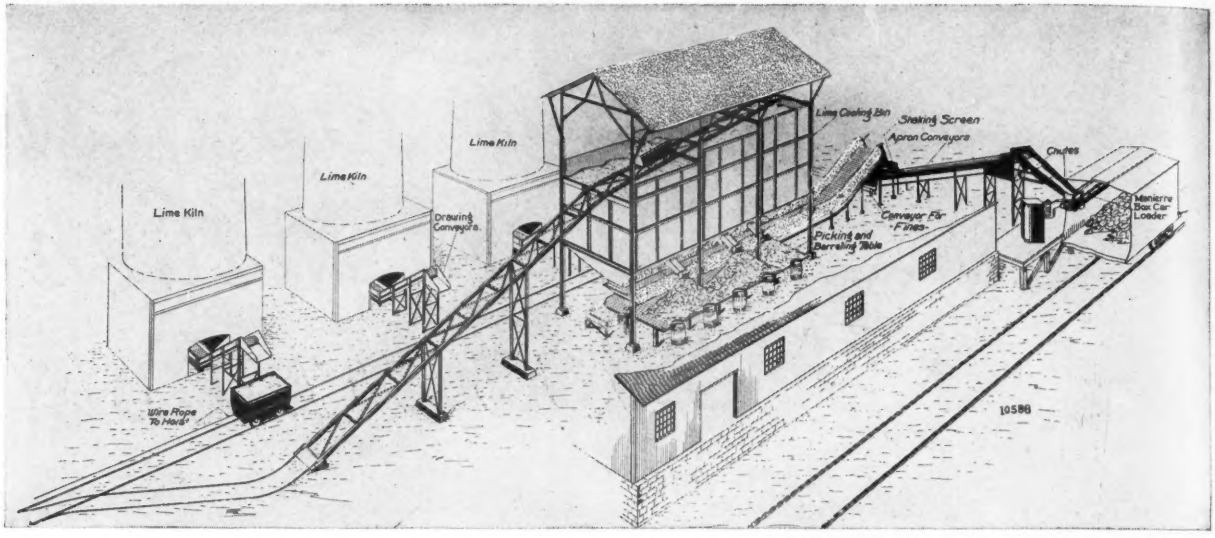
Get in line with these up-to-the-minute operators and cut your production costs. Get away from the old methods and operate your plant with the modern equipment that will enable you to meet competition with open arms.

Let Us Solve Your Problem
Write Us for Photographs and Description

With such equipment operators of mines and quarries are moving thousands of tons daily

INTERSTATE EQUIPMENT CORPORATION

25 Church Street **New York City**



To the Lime Plant Operator

HOW would you like to draw all your kilns with two men? We can show you how.

WOULDN'T it help your operation a lot to have a lime storage bin between the kilns and cars? We build them.

IT sounds interesting to hear that you can pick all your core with one man, with the lime passing slowly by for inspection on a simple conveyor. Doesn't it?

THE fines can be taken out of your lump lime automatically and with no hand labor. We build a screen that does it.

DO you know that an overhead gravity chute will enable you to fill barrels with lime five to ten times as fast as your present hand shoveling method? It will.

IF you have to sort your lime into two or more kinds before shipping, seat a couple of men beside a sorting conveyor and let them replace the ten or fifteen you normally need (and pay) to do this special kind of work.

IT can be done.

WHY not load your bulk lime into box cars with a loader? One man can set the loader in position, fill one end of the car, reverse the loader, fill the other end, in less than one hour. This is not the same kind of work as the wheel-barrow-plank-back-breaking way. Ask the man who has tried both.

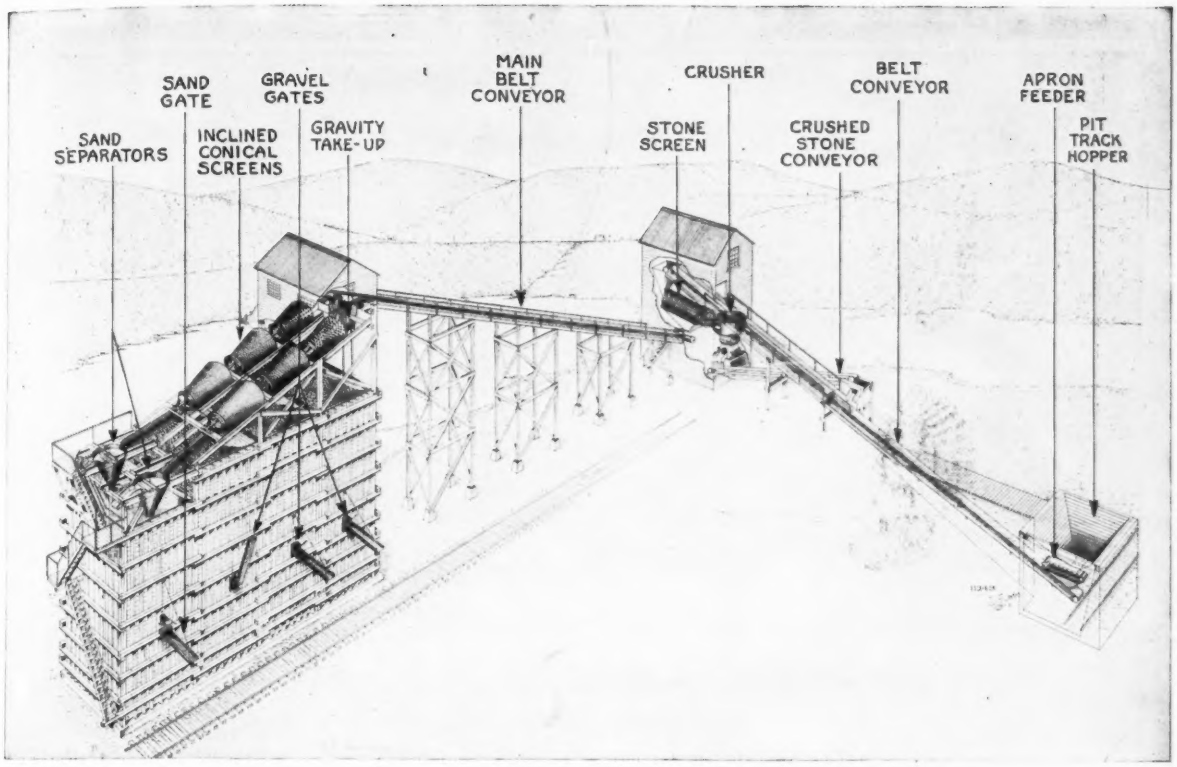
ISN'T it logical to make a factory out of a lime plant? There are more wheel-barrows and muscles used in handling lime than any other large industry you can think of. We can eliminate a lot of it and save you the cost of investment in less than two normal years. Send for our Book No. 416.

THE Link-Belt line includes elevators and conveyors, locomotive cranes, portable loaders, electric hoists, stone handling equipment, sand and gravel plants, car loaders and unloaders, screens, feeders, hoppers, crushers, chains, wheels, buckets, etc. Send for catalogs.

LINK-BELT COMPANY 885

PHILADELPHIA—Hunting Park Ave. and P. & R. Rwy. CHICAGO—300 West 39th Street

LINK-BELT



To the Sand and Gravel Plant Operator

Link-Belt engineers have spent years in the study and development of methods for the efficient production of sand and gravel. Out of this experience they have learned what to do and how to do it.

We take full responsibility for the work from the start to the completion of the plant. The entire layout and design is by our own engineers and all the machinery is manufactured in our own modern shops.

Each Link-Belt plant is built to secure the greatest commercial advantages for its owners—whether the desired output be 10 or 300 carloads a day.

Each plant has its individuality, and the details of design make it the most efficient for its work, from every standpoint—economy of operation—high quality of material—simplicity—durability—reliability, etc.

Link-Belt screens, scrubbers, sand separators, excavators, spouts, gates, feeders, water pans, belt conveyors, bucket elevators, etc., are features of Link-Belt plants that earn dividends for their users.

If you contemplate additions to, or changes in your present equipment, or a new plant, why not put your problem up to our engineers?

Send for catalog No. 440.

LINK-BELT COMPANY 886

PHILADELPHIA—Hunting Park Ave. and P. & R. Rwy. CHICAGO—300 W. 39th Street

LINK-BELT

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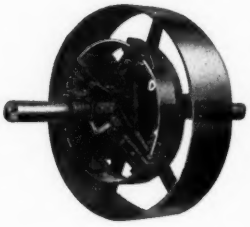

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Insure the continuous working of your Elevating, Conveying and Power Transmission Machinery, by keeping spare parts constantly on hand.

Be prepared for increased business by having all your equipment up to its most effiicent working order. Replace that bucket or chain—now. Make that extension to your plant—now!

C-3

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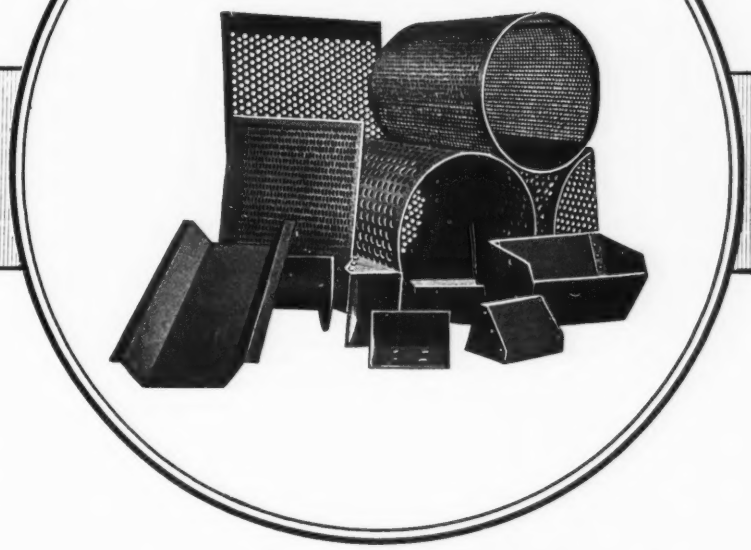

PERFORATED METAL SCREENS

FOR

STONE · GRAVEL · SAND · ETC.

We will make perforated metal screens to meet your most exacting requirements.

Right now when you are considering the necessary improvements and replacement of old and worn equipment, is the time to think of the Hendrick Screens.

The material, exactness in manufacture, and promptness of delivery are deep and firmly rooted traditions of this organization, and it is because of these traditions you will find unusual service here.

Elevator Buckets built specially for Your Needs

Conveyor Trough, Flights, Stacks, Tanks
General Sheet and Light Structural Work
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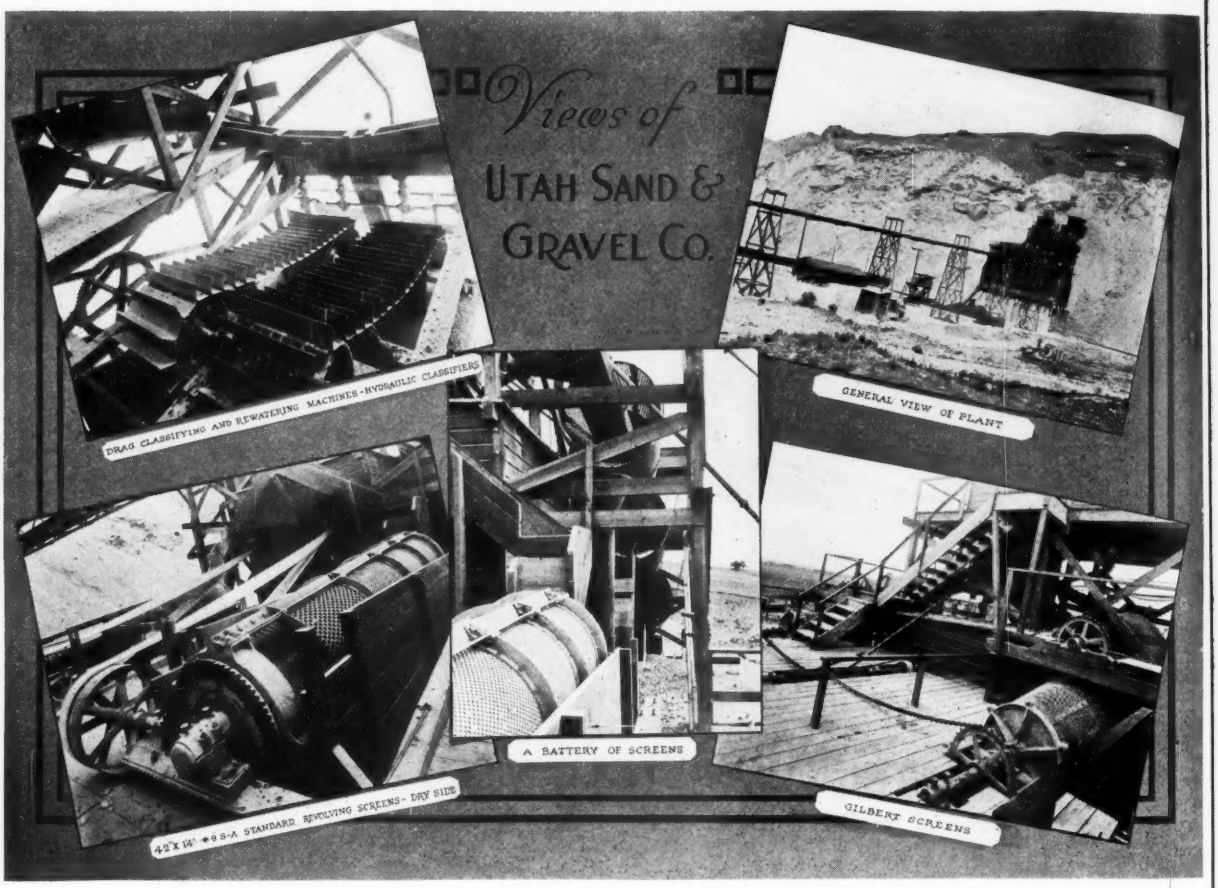
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42'X 14' S-A STANDARD REVOLVING SCREENS - DRY SIDE
GILBERT SCREENS

S-A Washing and Screening Equipment Installed in Utah Plant. This Plant furnishes Washed and Sized Gravel and Clean Sharp Sand to the Salt Lake City District.

CLEAN aggregate is essential for the production of good concrete. Gravel must be thoroughly washed to remove the clay film which is present in bank-run material and which is detrimental to bonding qualities of any cement.

S-A sand and gravel washing and screening plants are producing the highest grade concrete gravel with standard equipment. Each plant is designed in accordance with standards established after years of successful experience in this field.

The design of each sand and gravel project presents new and important problems which must be given careful study by experienced technical men. S-A engineers are designers of successful plants and their services are available to those contemplating new projects.

Write for Section 5-R Catalog

STEPHENS-ADAMSON MFG. CO., Aurora, Illinois

Model 31—*The "Happy Medium" Dragline*

The picture above shows a Model 31 Marion Dragline with a ¾ cu. yd. bucket at the Tennessee-Illinois Phosphate plant located near Centerville, Tenn.

In this case the Marion is removing an overburden that averages 12 ft. in thickness and has performed the duties for which it was designed at an exceptionally low yardage cost.

These machines are unsurpassed for simplicity, accessibility and the quality of the material and workmanship.

In steam shoveling there is a "happy medium" just as there is in anything else. The Model 31 is our "medium" shovel. It fits between the "21" which carries a 3/4-yd. dipper and the "36" regularly fitted with a 1 1/2-yd. dipper. For the average plant the Model 31 is the **Ideal Machine.** Shovel equipment is readily interchangeable with dragline attachments. Flexible crawler trucks make hard going easy. Can be furnished with Steam, Gasoline or Electric Power.

Send for Bulletins

THE **Marion** STEAM SHOVEL CO.

Established 1884 Marion, Ohio

New York Chicago Atlanta San Francisco

EVERYWHERE RELIABLE — THE Marion STEAM SHOVEL CO. — ESTABLISHED 1884

Boise, Idaho, Clyde Equipment Co.
Billings, Mont., Connelly Machinery Co.
Dallas, F. B. Wright, Busch Building.
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Philadelphia, H. L. Cox, 13th and Cherry St.
Pittsburgh, J. W. Patterson.
Vancouver, Vancouver Machinery Depot, Ltd.
Montreal, Toronto, F. H. Hopkins & Company, Ltd.
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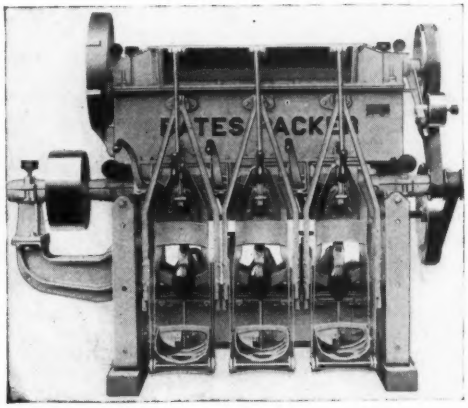
BATES SYSTEM for

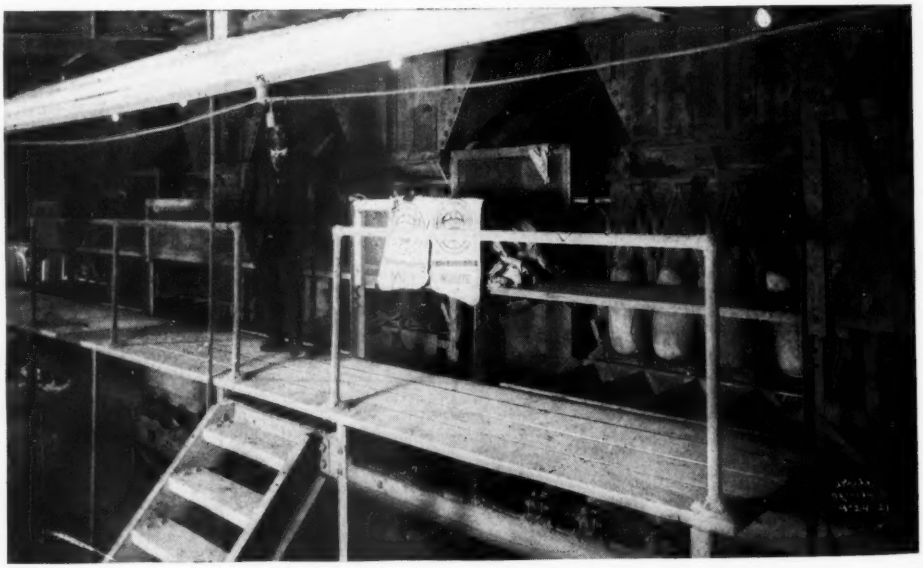
Bates Packers



are filling 98% of the bags of cement manufactured in the United States and the total output of Canada, Australia, and New Zealand. They are also operating in South Africa, India, Japan, France, Spain, Sweden, Norway, Great Britain, Mexico and Cuba.

The Bates System using the self-closing feature of the Valve Bag eliminates all lifting of filled bags and avoids the necessity of tying the bag during sacking process, hence its speed and economy.

Let Bates solve your Packing problem. Complete information given upon request.



BATES VALVE BAG COMPANY

Filling and Closing BAGS

Bates Wire Ties

have long since been universally accepted as the most secure, saving, and efficient means for closing bags of all sizes and descriptions.

Over three hundred million bags were closed the Bates Way during 1921 in the Rock Products Industries alone. In fact, those who have learned of it use nothing else.

Bates Wire Ties and Tools are fast displacing the old plier method for fastening the intersections of concrete reinforcing bars.

A Free trial of Bates Wire Ties will convince you and will show you how we save time and money for our big family of satisfied customers.

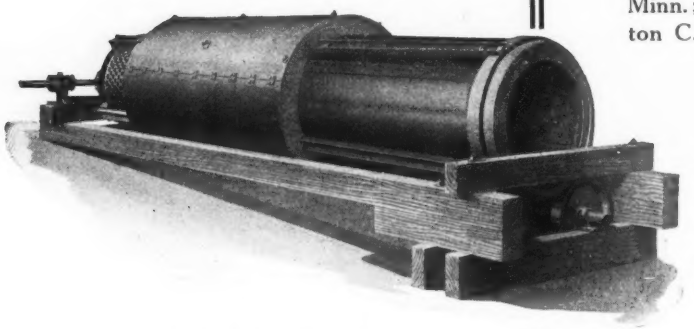
Do you not wish to learn of the efficiency, practicability and economy of these ties and tools?

A Free Trial Outfit

consisting of one tying tool and liberal samples of wire ties suitable for your purposes will be gladly sent upon receipt of your agreement to try it on your work and, within fifteen days send us $3.50, the price of the tying tool, or return it to us. The sample ties cost you NOTHING.

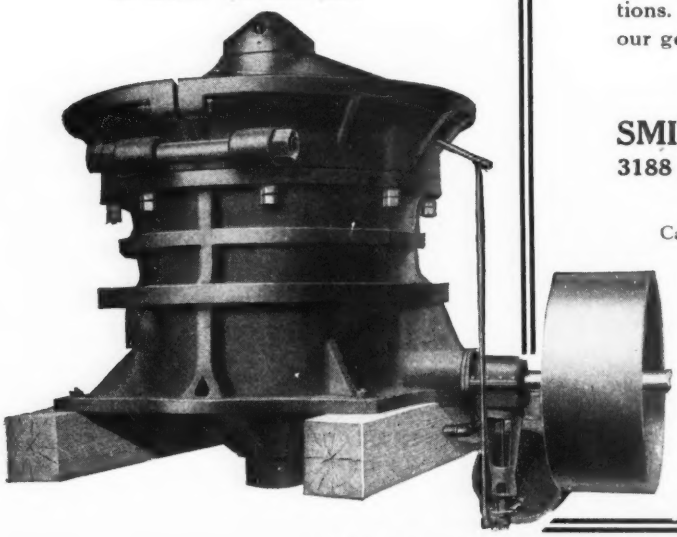
7334 So. Chicago Ave., CHICAGO, ILL.

Telsmith Belt Conveyor in a prosperous middle-western gravel plant



Telsmith Heavy-Duty Gravel Washer. Built in three sizes

Telsmith Primary Breaker—the crusher with the rigid shaft and the famous "parallel pinch"



TELSMITH BUILDS
Complete Gravel Plants

During the last five years, Telsmith has equipped scores of gravel plants all over the country, including the following: Fay Sand & Gravel Co., Chisholm, Minn.; Woodbury County Gravel Pit, Correctionville, Ia.; Robbins-Young Co., St. Paul, Minn.; Central Michigan Gravel Co., Lansing, Mich.; A. H. Prange, Grand Rapids, Mich.; Westminster Sand & Gravel Co., Lima, Ohio; Crystal Lake Crushed Stone Co., Sheboygan, Wis.; Salem Sand & Gravel Co., Wilkes-Barre, Pa.; Crawford Sand & Gravel Co., Meadville, Pa.; Kerr & Murphy, Connersville, Ind.; City Gravel Pit, Red Wing, Minn.; Fayette Sand & Gravel Co., Washington C. H., Ohio; Beckwith Gravel Co., Lansing, Mich.

With two exceptions, these plants were designed by Telsmith engineers; and were equipped throughout with Telsmith machinery—Telsmith crushers, Telsmith bucket elevators, Telsmith belt conveyors, washing screens, feeders, sand tanks, bin gates. In each case, the buyer got a well designed plant, suited to his local conditions, with all elements in good balance and properly "hitched up."

The list is only a short one. A complete list of Telsmith installations would resemble a young directory. We'd like to add your name to our roster of successful Telsmith installations. Just drop us a line and we'll send you our general bulletin G. P. 11.

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3188 LOCUST ST. MILWAUKEE, WIS.

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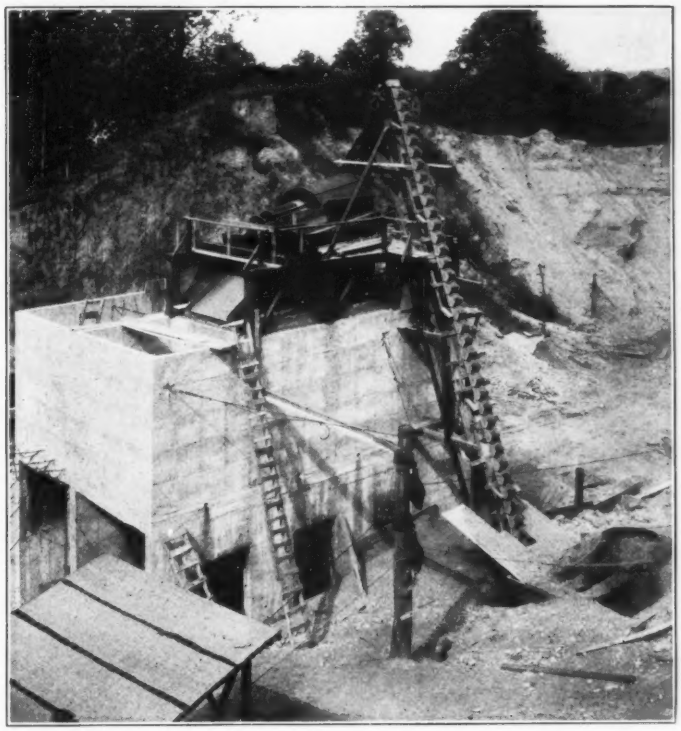

WEBSTER EQUIPMENT

Whether in large or small sand and gravel pits, an efficient elevating and conveying system requires thorough engineering.

WEBSTER EQUIPMENT is specified in sand and gravel operations of all sizes because it gives sustained efficient service at lowest possible cost.

Webster engineers have accurate, scientific knowledge of material handling equipment and will be glad to design elevating and conveying equipment to meet your special requirements.

THE WEBSTER MFG. COMPANY

4500-4560 CORTLAND ST., CHICAGO

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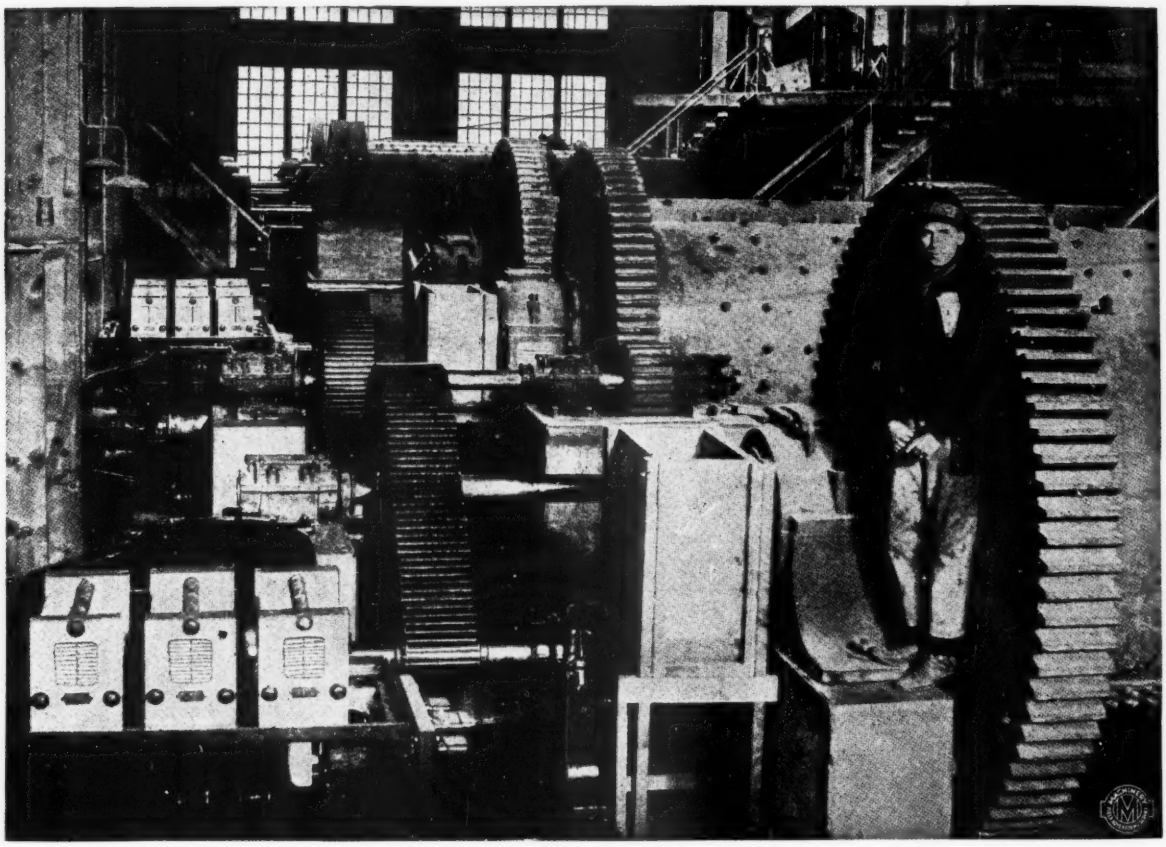
MORSE SILENT CHAIN DRIVES

THE MORSE "ROCKER JOINT"



Profits assured by Morse Drives

Six in Sight—More on Another Floor

MORSE Rocker Joint Silent Chain Drives installed about a year ago in plant of Canada Copper Corporation, Ltd., Allenby, British Columbia, in severe service, transmitting 99% efficiency from 100 H. P. motors to 5′ x 20′ Tube Mills.

Have you troublesome drives in Hard Service in Dust, Gases or Steam? Let us show you how to save fuel, increase production, lower maintenance costs and bring out the profits lost through slipping belts.

Our Sales Engineers are Power Transmission Experts, who make it their business to secure results that are the best available for your Power Problem.

Consult us on heavy, difficult or expensive drives.

Benefit by MORSE SERVICE as Others Do.

MORSE CHAIN CO., LARGEST MANUFACTURERS OF SILENT CHAINS IN THE WORLD **ITHACA, N. Y.**

Morse Engineering Service ***Write for Booklet*** ***Assistance Without Obligation***

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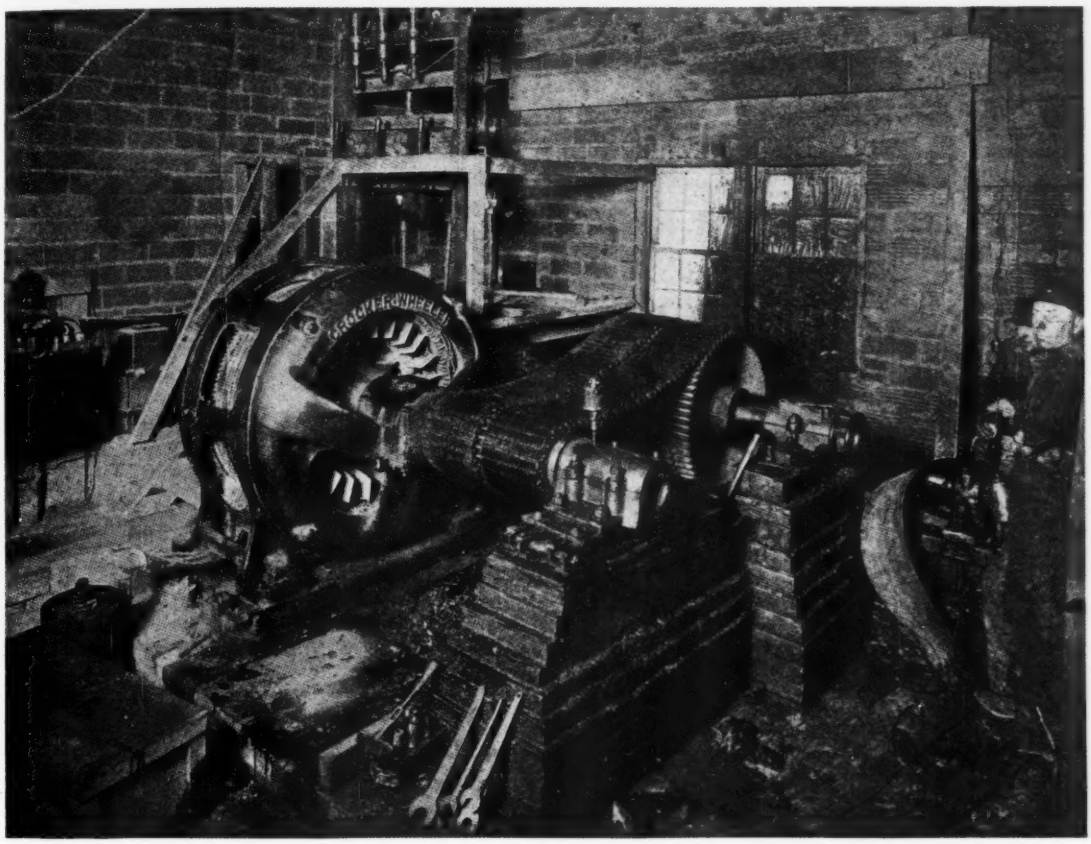
"Morse" is the Guarantee Always Behind the Efficiency, Durability and Service

MORSE SILENT CHAIN DRIVES

THE MORSE "ROCKER JOINT"

In many Industries Conditions like these exist



This is the Brick Mill of the Continental Clay Company at Massillon, Ohio. They have installed Morse Silent Chain Drives.

The 300 H.P. installation shown herewith, in a location exposed to substances which wear leather belting and interfere with its cling to the pulley.

Morse silent chains go on delivering 98.6% efficiency in the face of all drawbacks.

If your belts are subjected to unusual conditions of wear or exposure, or if you are losing power and money through belt slip, let the Morse Engineers help you. They gladly render "Assistance Without Obligation."

Benefit by MORSE Engineering Service as Others Do

MORSE CHAIN CO., LARGEST MANUFACTURERS OF SILENT CHAINS IN THE WORLD **ITHACA, N. Y.**

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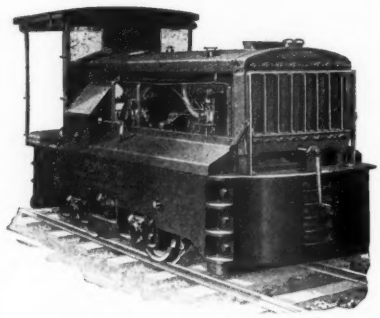
"Morse" is the Guarantee Always Behind the Efficiency, Durability and Service

See Our
Exhibit at
Good Roads Show
Jan. 16-26



New Model CL, Three and One-half Ton

See Our
Exhibit at
Good Roads Show
Jan. 16-26

PLYMOUTH
Gasoline Locomotives

"And They Never Gave a Minute's Trouble"

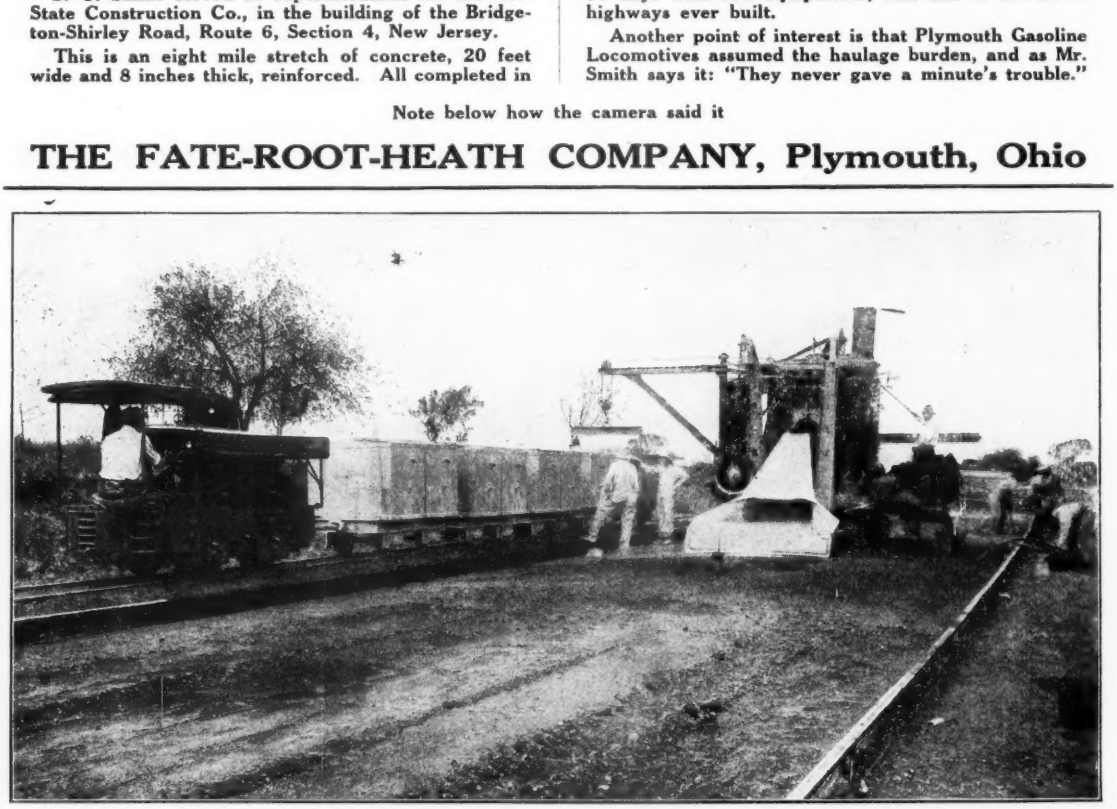
S. C. Smith served as superintendent for the Tri-State Construction Co., in the building of the Bridgeton-Shirley Road, Route 6, Section 4, New Jersey.

This is an eight mile stretch of concrete, 20 feet wide and 8 inches thick, reinforced. All completed in 90 days with two equipments, and one of the finest highways ever built.

Another point of interest is that Plymouth Gasoline Locomotives assumed the haulage burden, and as Mr. Smith says it: "They never gave a minute's trouble."

Note below how the camera said it

THE FATE-ROOT-HEATH COMPANY, Plymouth, Ohio



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Rock Products

Volume XXV | Chicago, January 14, 1922 | Number 1

The Rock Products Industries

Have Just Passed Through One of the Most Trying Periods in History—Faced with Many Big Problems, But the Future is Brightening

THE ROCK PRODUCTS INDUSTRIES in 1921 generally did not have as good a year as the preceding one—1920. Conditions were very spotty. Nearly all the activity visible came from house building or road building, or both. In localities where these lines were not active, business was mighty poor. The stagnant condition of the iron and steel industry was reflected in the flux stone and silica sand industries. The deplorable state of agriculture practically annihilated—temporarily—the rock phosphate producers, and resulted in a very small production of agricultural lime and limestone. The lessening activity of the chemical industries had a considerable effect on the lime industry. The portland cement industry alone held its own, and this was only so because great activity in the East and Central West offset a decrease in production in the South and Far West.

Sand and Gravel

The high points in the sand and gravel industry in 1921 were the long hard struggle for lower freight rates and, in some localities, heart-breaking price wars. The price charts, elsewhere in this issue, do not tell the whole story, for in at least two localities in different parts of the country sand was sold as low as 10 c. per ton, and in at least two other localities as low as 20 c. per ton. Unquestionably a more general knowledge of the industry acquired by producers during the last two or three years through their association activities and the market-news pages of ROCK PRODUCTS was a very important factor in preventing much more serious results from these price wars.

In the matter of freight rates the industry fared indifferently. The maximum reductions, or concessions, were those in New York State, Oklahoma, and possibly a few other states where the state public service commissions succeeded in inducing the railways to accept a return to the August, 1920, scale without protest. In Ohio the same scale was put into effect under protest, and in Wisconsin, Michigan and some other states reductions were made amounting to less than the 1920 increases, under orders of the state commissions. In New England, the Middle Atlantic States and in some other localities rates were voluntarily reduced by the railways.

In every way the National Association of Sand and Gravel Producers with headquarters in Washington, D. C., played an active part with the Interstate Commerce Commission, with the railway executives and with the local state commissions. These efforts of the National Association culminated in the hearing granted to the industry by the Interstate Commerce Commission on January 16, 1922, in which the fairness of the freight rates on sand and gravel in the Central Freight Association territory are to be determined. This is in the nature of a test case and developments for the country as a whole will largely hinge on its disposal.

Producers universally believe that high freight rates have been the chief deterring influence to much greater production; and in this belief every scrap of evidence shows they are justified. The large production of portland cement in 1921 was not accompanied by a corresponding production of commercial sand and gravel; consequently it is evident that much local material was used where commercial material would have been used under more favorable transportation conditions.

The bulk of the business reported is still rail business as the results herewith show: Rail, 70 per cent; truck, 27 per cent; water, 3 per cent. With very few exceptions all the new plants reported in 1921 were wholly trucking or water-transportation plants, and the increasing use of the motor truck for hauling from plant to job was one of the outstanding developments of the year. Nevertheless, there is every reason to believe that this phase of the sand and gravel industry reached its maximum development in 1921, and that we shall see a return to the central plant with rail shipments in the near future.

Central Plants Will Win

These sporadic developments of local pits have occurred time and again in the history of the industry, and certainly no period in that history was more favorable to their development than 1921. Yet, in spite of all the handicaps in connection with the operation of rail plants they were by no means eliminated. The factors involved are more than mere "delivered price" of the material—they are service, quality and responsibility, and persistent education along these lines will eventually accomplish results.

It is very generally agreed that the cost of production at central plants can and should be reduced. That such costs can be reduced, and by the very simple process of increasing their production, is obvious when it is realized that in no section of the country was anywhere near the capacity of existing plants developed in 1921. For the country as a whole only about 50 per cent of their capacity was utilized. Obviously few plants were efficiently operated under such conditions.

Therefore it is evident that high freight rates not only give local trucking plants an advantage in delivered price due to the freight bill, but also materially increased the cost of production at rail-shipping plants by restricting production and forcing uneconomical operation.

Conditions in this year of 1922 are bound to be better, because, as a number of producers aptly put it, they can be no worse. Little or no railway ballast was sold in 1921 and there are prospects of considerable business in this line in 1922. There will probably be a slight decline in wages and there will be other operating economies which will help producers to meet side-of-the-road competition.

Practically all producers look forward to larger production in 1922 than in 1921 and many are preparing to meet it by increasing and improving facilities.

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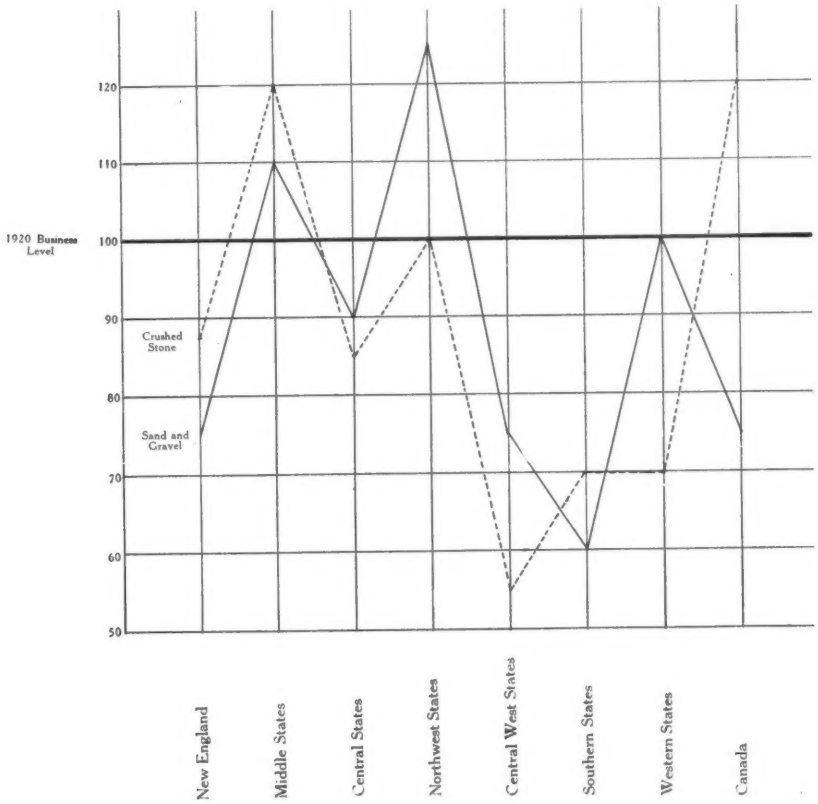
Crushed Stone

The most prosperous localities in the crushed-stone industry in 1921 were New York, New Jersey, Pennsylvania, Indiana, Minnesota and the Dakotas, Texas and Canada. This prosperity was due almost entirely to road work. The railways bought very little ballast, except in a few Eastern localities. The limestone business of Pennsylvania, Ohio, Michigan and Illinois was very seriously affected by the inactivity of the steel industry, which unfortunately came at a period when agricultural limestone demands were also at low ebb. The steel industry has already begun to show signs of recovery, while the agricultural outlook remains about the same.

High freight rates were of course the most important factor in preventing a larger production of crushed stone for road work. Their effect was not only to increase the use of side-of-the-road sand and gravel, but to deter much contemplated road work until conditions were more favorable. In Wisconsin, where local quarries and pits are easily opened, the crushed-stone producers suffered more than the gravel men from side-of-the-road competition. For the sand and gravel business of Wisconsin in 1921 was 120 per cent of the 1920 business, while the crushed-stone business was only 87 per cent. As a large part of the material in both years was used for the same purposes, this instance gives an excellent example of the effect of such local competition on the quarry business, when the principal type of road built is concrete.

Notwithstanding the fact that the few states mentioned did as good or better business in 1921 as in 1920, in not one case was more than 85 per cent of the productive capacity of the plants utilized. This was the case of New Jersey, which had 30 per cent larger production in 1921 than in 1920. New York State, which produced 50 per cent more in 1921 than in 1920, utilized only 70 per cent of the capacity of the plants reporting. In the Central West not over 40 per cent of the productive capacity of the plants was utilized in 1921.

The quarry industry is more exclusively a rail-shipping industry than sand and gravel for reasons that are obvious. Figures compiled from our questionnaire show the proportions moved by rail, truck and water in 1921 as follows: Rail, 75 per cent; truck, 24 per cent; water, less than 1 per cent. A great deal more crushed stone was moved from plants to jobs than ever before, and the prosperity of the Eastern plants was in no small measure due to the fact that existing paved roads made truck deliveries up to 20 or 30 miles feasible.



Illustrating the spotty character of the mineral aggregate industry in 1921

Much that is said in regard to sand and gravel, of course, is equally true of crushed stone. The majority of operators believe production costs can be materially reduced, and increased production is the largest factor in reducing costs. With a considerable volume of ballast or flux stone business it is inevitable that more efficiency will result in many large operations. In most cases some slight reduction in wages is looked for.

Lime

The best indication of where the biggest part of the 1921 lime production went is evidenced by the percentages of the 1920 business done in various localities. For example, Ohio lime plants had 90 per cent of the business done in 1920; Wisconsin, 105 per cent. The Eastern States produced only 60 per cent, the South about 50 per cent, the Central West about 70 per cent, the Southwest 50 per cent and the Far West 80 per cent of their 1920 tonnages. In other words the two states which produce large quantities of finishing lime for plaster had as good or nearly as good a year as 1920.

The year 1921 was a fair one for small building construction and the plants which served this field had a fair year. The thriving condition of the building industry in the territory served by the Wisconsin plants is all the more in evidence because these plants have lost a large volume of paper-mill business in the last one or two years, due to a change in the process of paper making.

However, neither the Ohio nor Wisconsin plants produced much over 60 per cent of their possible capacity. In other districts production was as low as 40 per cent of plant capacities.

There were some price wars in lime, but in general prices were fairly firm, as they must be under such uneconomical conditions of operations, if an industry is to avoid utter disaster.

The prospect for 1922 in the lime industry is considerably better. The steel and other metallurgical industries are picking up and the volume of small building work bids fair to be as much or more. There will probably be a larger volume of office and similar building work. And there is a slight prospect of better agricultural conditions.

The lime industry is far better organized than ever before to corner its share of general building work and undoubtedly its work already in this direction has done much to save the industry from harder times in 1921 than it really had.

All things considered the lime industry has withstood a most trying time without extraordinary difficulties. As one Eastern producer puts it: "There are indications of too much pressure on selling;

and when 16 salesmen, more or less, hammer at a prospect, he gets suspicious and sometimes does not buy what he originally intended to. In these thin times manufacturers are prone to extend territories when there are no good business reasons for it. They like to get both feet and a couple of snouts in the trough."

Of course the outlook for lime and other commodities which depend in a large measure on general business conditions is less certain than that for cement and aggregates for which there will be a large demand on account of highway and other public work already provided for. Yet the lime men have an optimistic view of the situation, admirably voiced by a most prominent Eastern producer as follows: "We look for a decided improvement in 1922. Good evidences are already in sight. Production less than consumption is creating a void, and business must soon get under way. Many problems of liquidation have been solved. There is a broader feeling of encouragement and optimism on the part of the public."

There is no loss without some small gain. One lime producer reports that the outstanding developments in 1921 were "better goods and better service to keep up in business." We are inclined to believe this will help in the long run, although the lesson may be costly.

Portland Cement

Progress in the production in portland cement has been published from month to month in Rock Products. While the figures for December are not available at this writing, it is evident that the 1921 production equaled approximately the 1920 production, which was the largest on record. The first guess would be that most of this went into concrete roads and pavements, but it seems that the manufacturers' own figures show that less than 25 per cent was so used, the great bulk of 1921 production going to dealers. Apparently it was for a variety of building purposes that the major part of the 100,000,000 bbls. was used. This would account for the failure of commercial aggregate production to keep pace with cement production. Obviously local material in very small lots was used with this cement in the majority of instances. With work of a larger or more important character the same volume of cement business would have meant a larger consumption of commercial aggregates.

Eastern cement plants did about 16 per cent more business than 1920; and Central West plants about 32 per cent more. Southern and West Coast plants did from 20 to 25 per cent less business. However, Eastern and Middle West plants did not produce more than 75 to 80 per cent of their possible capacity.

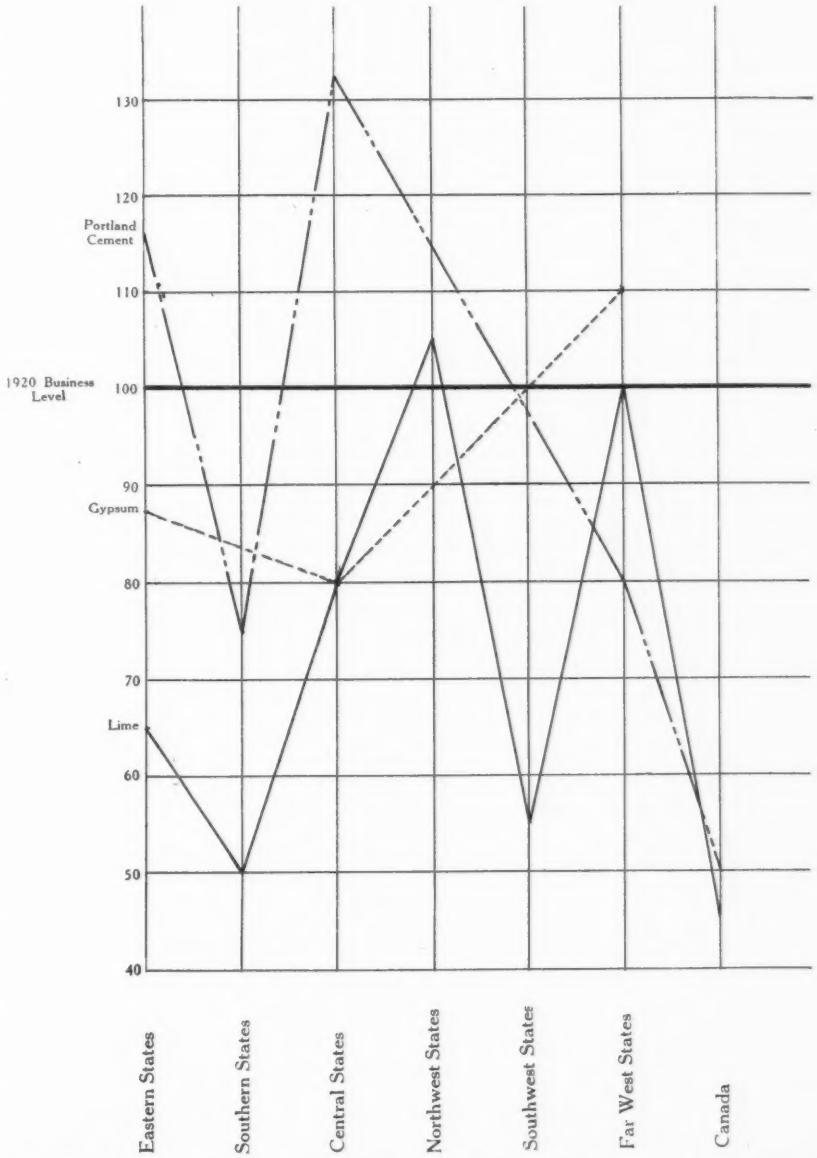
Conditions in the portland cement industry were more nearly normal than in any other of the rock-products industries and the prediction is that prices will remain about as they are, except what may be gained in the matter of freight rates on such raw materials as coal, which still costs manufacturers, delivered, about three times the pre-war prices.

The outlook in the cement industry is excellent. There will continue to be a large volume of small building work, a larger road-building program, and at this writing every indication of considerable improvement work by the railways. There are said to be more inquiries reaching cement manufacturers about next season's deliveries than ever before in the history of the industry.

Gypsum

Next to portland cement producers gypsum plaster manufacturers had the best year. Prices were firm and production in the East was up to 88 per cent of the 1920 production. In the Central West it was 80 per cent and on the West Coast it was 110 per cent. In the East only 75 per cent of the possible capacity of the plants was utilized; in the Central States 65 per cent, and in the West Coast States 33⅓ per cent. The reason for this apparent discrepancy is that several new plants have been developed recently in the Far West.

Like the cement industry, the gypsum industry depended largely on many small building operations for the consumption



Comparison of the 1920 and 1921 production of portland cement, gypsum and lime

of its finished product. The prosperity of the cement industry of course created a large demand for crude gypsum. The outlook for 1922 is certainly as good as the year just passed, and if general building—office buildings, etc.—picks up, the gypsum industry will certainly share in the increased demand for plaster and other gypsum products.

During the year a number of new uses were developed for gypsum in building work, and the industry conducted quite an intensive campaign to standardize its various products.

Silica Sand

Producers of silica sand had to contend with a diminishing iron and steel production and a somewhat decreased glass production. The resumption of the Belgium glass industry had quite a serious effect on the export business of American manufacturers, and the demand for glass during the war has not been equaled since. There was considerable overproduction in the silica sand field and there was some severe price cutting that is not shown in the price charts elsewhere in this issue.

The high freight rates, and the differentials in favor of sand that moved as building sand as against sand for foundry and glass-making uses, had a very disorganizing effect on the industry. These difficulties the silica sand industry is now using every effort to overcome.

The production of silica sand in 1921 for the Eastern territory averaged only 36 per cent of the 1920 production. For the Central West it was 40 per cent, and for the Far West 60 per cent. None of the plants produced more than 33½ per cent of their capacity and many less than 25 per cent.

The outlook for 1922 is rather uncertain, but at this writing, with the steel industries rapidly picking up, the production of silica sand in 1922 should be at least 50 per cent more.

Talc and Soapstone

Talc production in 1921 was about 25 per cent of the previous year's output. General business depression was the cause, as talc has a variety of uses in many industries.

Slag

The slag industry shared about the same fortunes as the other aggregate industries in the East, where all the slag plants except two or three are located. The production of slag in 1921 was 90 per cent of the 1920 figure, which is better than the general average for either crushed stone or gravel. Slag producers, of course, have the same freight-rate problem, but they have endeavored to solve it by working with the railway managements rather than through the public rate-making commissions.

Sand-Lime Brick

The sand-lime brick industry had a production of about 50 per cent of the 1920 figure—largely on account of the freight rates which restricted the shipping radii and compelled the use of competitive material. Several new sand-lime brick companies were organized and several new plants are under construction.

Concrete Brick

The growth of the concrete brick industry was one of the outstanding developments of the year, and is today one of the subjects of livest interest among mineral aggregate producers.

Rock Phosphate

The worst sufferers from the buying strike of the farmers were the rock phosphate producers of Tennessee. Scarcely 15 per cent of the 1920 figure was produced in 1921. The Florida producers, because of a considerable export trade, fared much better.

General Conclusions

Most of the foregoing, it must be confessed, reads something like a tale of woe. Nevertheless there is much to be thankful for. Competitors, as a general rule, met the situation in a much more enlightened manner than in any previous period of like circumstances. Production has generally been kept down to somewhere near the demand and operators have had more respect for the rights of others than one would naturally expect in such trying surroundings.

The national trade associations have all held their flocks together and several have grown much in prestige and usefulness in spite of a shortage in expected income and dissatisfaction with general conditions on the part of the members.

The greatest problem of the mineral aggregate industries—crushed stone, sand, gravel and slag—appears to be the development of closer and more friendly relations with the railways, with contractors, engineers, architects and all users of these commodities, to drive home the advantages and virtues of materials produced to meet strict specifications, and to avoid any letting down of bars to inferior materials, which may temporarily fill the gap. As the railways become buyers of these materials every effort must be made to link up prices with decreased production on account of high freight rates and restricted movement of the materials.

It is to be hoped that the commercial mineral aggregate industry will soon be in a position to undertake the proof, from its own tests and investigations, that it pays to use a properly prepared and proportioned aggregate, as against an imperfectly turned-out makeshift. If the cement industry and the aggregtae industry would unite to compel the use of enough more cement to make good the deficiencies of a poorly graded aggregate, both industries and the public would be beneficiaries.

Before winding up this narrative the editor wishes to thank, most heartily, each and every producer who has contributed the information from which this summary is made. The returns from this questionnaire break all records we have ever heard of for such propositions. Over a third of all our readers responded; so that, while the work of digesting them was made more difficult, the results represent, we earnestly believe, an excellent cross-section of the whole industry.

Market for Cement in Guatemala

THE DEMAND for cement in Guatemala incident to rebuilding operations following the earthquake has had a greater effect upon the local production of this article than upon its importation, states Consul Arthur C. Frost of Guatemala City. While the value of the imports increased from $40,572 in 1913 to $79,646 in 1919 and $69,639 in 1920, the amount in kilos (2.2 lb.) has decreased from 4,314,804 in 1913 to 3,955,749 in 1919 and 1,654,724 in 1920. There is a large American plant producing cement in Guatemala, which supplies an important share of the local demand. However, for some work imported products are preferred and considerable quantities continue to be imported.

During 1913 the United States supplied slightly more than half of the cement imports, in 1919 it supplied all of the amount brought into the country and in 1920 it shared one-thirteenth of the imports with Germany.

It is preferable to ship the cement in sacks, owing to the loss through breakage of barrels and because inland transportation away from the railways is by oxcarts or mules over poor roads.—Commerce Reports, January 9, 1921.

Missouri's Limestone Demonstration in Movies

BECAUSE of the interest shown in limestone by Missouri farmers during the past two years, the State College of Agriculture has found it necessary to secure information from every possible source to present the information requested. In this connection a moving picture film has been secured that illustrates the practical needs for limestone.

Prof. Schowengerdt of the soil department of the Missouri State College of Agriculture has charge of the arrangements for showing this film. General discussion will follow the picture, thus affording the opportunity for additional information on the subject illustrated.

Review of Rock Products Prices During the Year 1921

Average Prices Show Steady Decline—Considerable Variations in Declines Shown in Different Localities

A STUDY of the prices of the various rock products should be both interesting and of considerable value to producers in making them better acquainted with their material in its commercial phases.

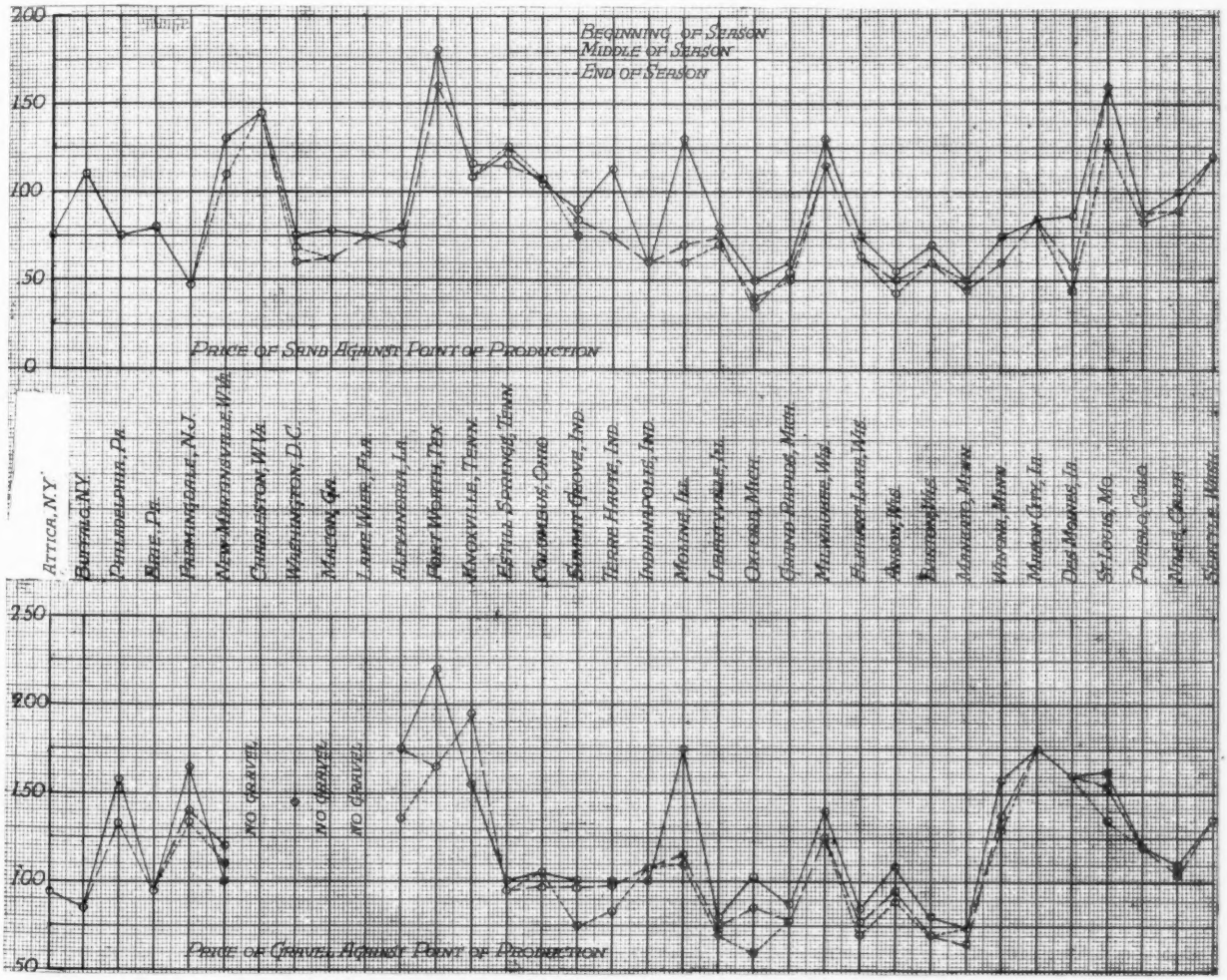
Owing to the generous co-operation of many producers throughout the country, ROCK PRODUCTS was able in 1921 to collect and quote prices at a great many more producing points than are shown in the accompanying graphs. Only typical producing points designed to show the price range in the industry from coast to coast and at a few points in Canada have been selected.

The prices plotted against a certain producing point do not necessarily mean that all the quotations came from a single producer, as in a number of cases they are average prices of several producers.

As in our graphical price review of last year, the most striking feature of all the graphs is the great variation in price for the same commodity in different localities. This is, of course, the result of both operating conditions and of local business, and in the case of silica, foundry sands, limestone and agricultural lime also probably depends in some measure on the quality or purity of the material.

Sand and Gravel

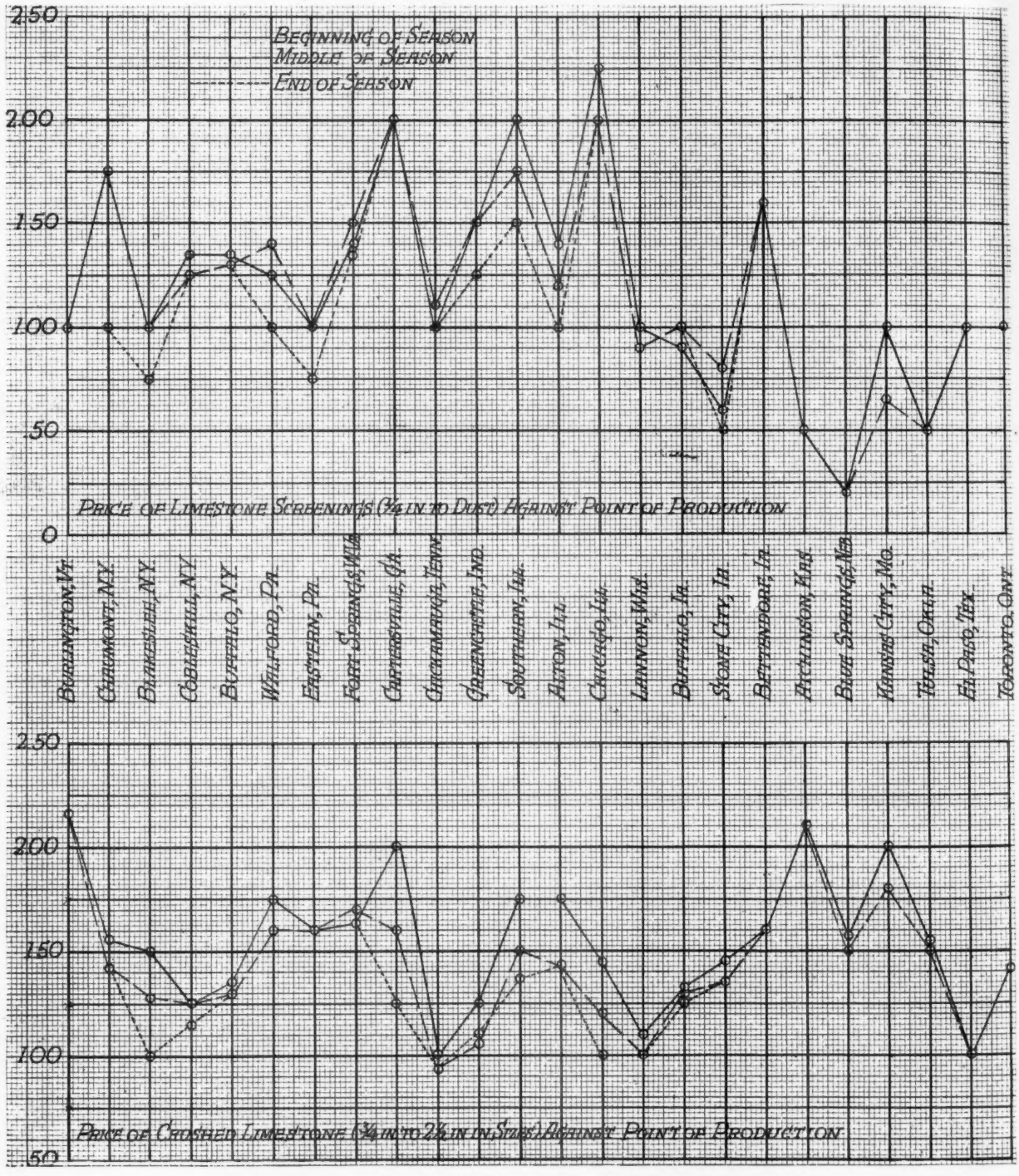
The average price of washed and screened sand in 1921 was about 92 cents per ton f.o.b. producing plant. This is only 2 cents higher than the average price of the same commodity in 1920. This is due to the fact that transportation difficulties still existed during 1921, thus in-



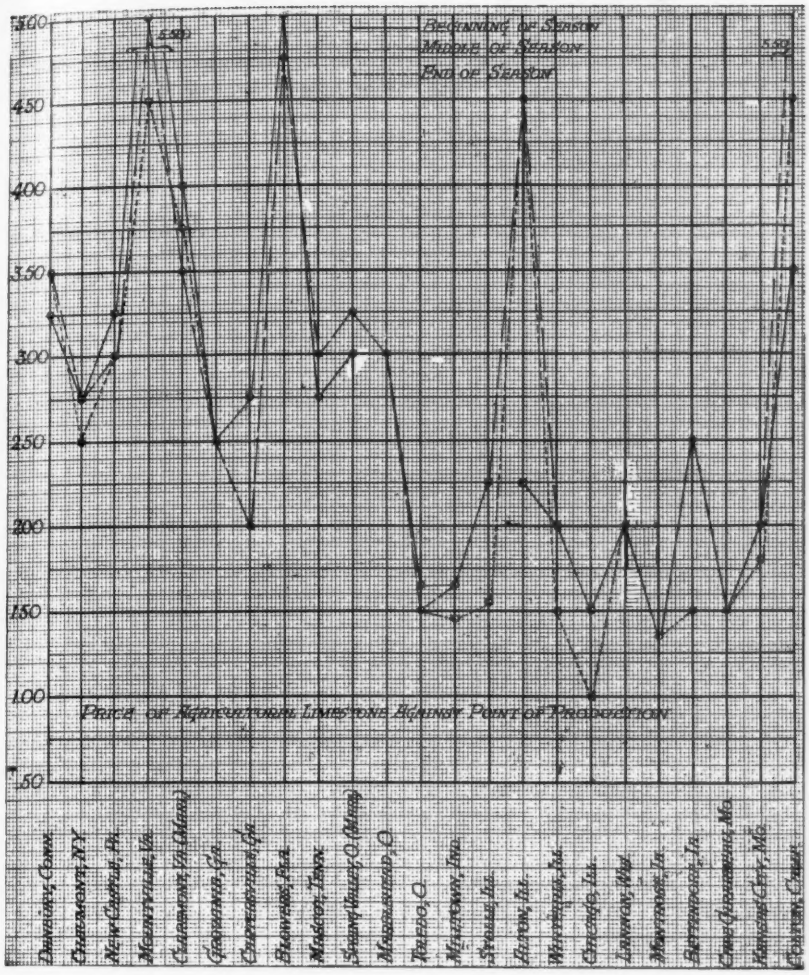
Price range of sand and gravel at various shipping points in 1921

creasing the use of local pit material, making the cost of producing washed and screened sand higher than under normal operating conditions. The average price of washed and screened gravel in 1921 was $1.20 per ton as against $1.30 in 1920. The percentage of decrease was therefore considerably less for sand than for gravel. This is probably accounted for by the fact that much more gravel was used for road work in 1921 than in 1920, while the use for sand in general building work was comparatively light until the latter part of the season. Building construction was worst hit by labor troubles throughout the country.

The highest points in the graph showing prices of sand and gravel at various shipping points are thus generally accounted for: They are either large industrial centers or a locality where either an excess of sand or an excess of gravel prevails, thereby making one or the other high. Some prices noted include freight, or charge for bringing the material to wharves or docks by barge. The prices throughout the Central West are



Price range of crushed limestone at various shipping points in 1921



Price range of agricultural limestone during 1921

generally shown to be lower than the extremes in the East, South and West.

Crushed Limestone

The average price of limestone screenings in 1921 was about $1.13 and of crushed limestone in various commercial sizes about $1.44, making the average price of all crushed limestone about $1.31 per ton f.o.b. producing plant, against an average of $1.40 per ton for 1920. The average price therefore decreased about 8 per cent in spite of all the difficulties of operation and transportation. The inactivity of the iron and steel industry and the stagnant condition in agricultural circles were reflected in the price and production of crushed stone.

The prices of crushed limestone shown in the graph having the various shipping points are also varied, the highest prices being at large industrial centers or in centers where there is a great demand for agricultural limestone or for crushed stone that is used for other special purposes.

Crushed Trap Rock

The average price of trap-rock screenings during 1921 was $1.36 and of crushed trap rock in commercial sizes $1.70, making an average price of $1.53 per ton f.o.b. producing plant, as compared to $1.40 per ton in 1920. The average price therefore increased 13 cents, or slightly less than 9 per cent. This increase was due to the great demand for this material for road building, especially in the Eastern states, and because trap-rock screenings are in great demand for top-dressing bituminous macadam roads, which are popular in New Jersey, Pennsylvania, Maryland and New York. The graph showing price range of trap rock at various producing or shipping centers shows a tremendous variation in price.

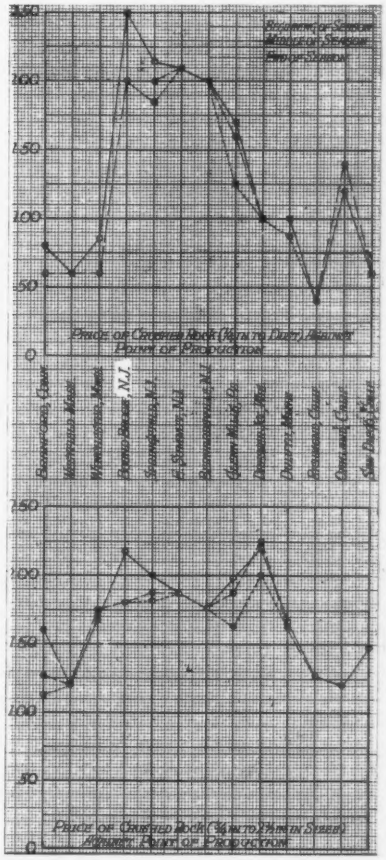
Agricultural Limestone

Agricultural limestone also shows a great variation in price from one end of the country to the other. The average price of agricultural limestone was $2.75 per ton in 1921, or 25 cents higher than the 1920 price. This increase is due to the fact that the production of agricultural limestone was abnormally low this year, and also that agricultural limestone is more carefully prepared now than before, resulting in a greater production cost. The unusual variation in prices at different localities is due to the variations in the fineness of the material.

Agricultural Lime

The average price of agricultural lime for 1921 was $7.60 per ton (bulk) f.o.b. producing plant, as compared to $8 per ton in 1920. This is a decrease of 40 cents per ton, or slightly more than 5 per cent. The decrease in the price of lime used for building purpoess was evidently reflected in the price of agricultural lime.

The analyses and quality of agricultural lime vary so much that the price comparison means little or nothing. Some manufacturers sell run-of-kiln lime for agricultural purposes, others their best grades. The price is also materially affected by the relative amounts of agricultural lime and other business done. For example, where there is a big demand for chemical lime or building lime, agricultural lime is only a side line, and the price of the latter



Price range of crushed trap rock during 1921

is fixed by the prices obtained for the same product used for other purposes.

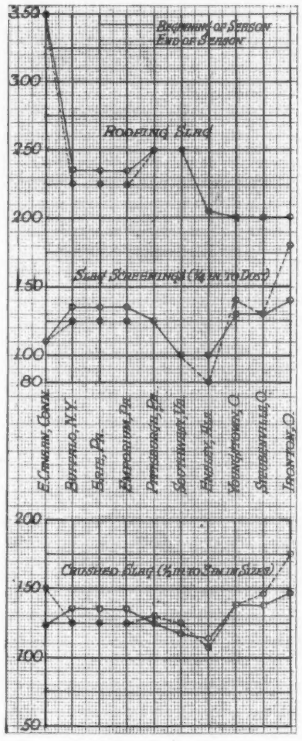
Crushed Slag

Slag prices were generally uniform, except in one or two instances, probably accounted for by the scarcity of competitive materials. The average price for slag screenings was $1.23 and for crushed slag in commercial sizes $1.31, making an average of $1.27 as compared to $1.25 in 1920. Roofing slag was about $2.60 per ton as compared to $2.25 per ton in 1920. This increase is probably due to the increased use of this commodity, the production being much greater in 1921 than in 1920.

Silica Sand

Glass sand showed a steady decline in price, with a slight increase toward the end of the season. The average price was about $2.50 per ton f.o.b. plant, as compared to $2.75 for 1920. This decline in price was due to the general inactivity in the glass business and also that the resumption of the Belgian glass industry curtailed American exports.

Foundry sands averaged about $2.14 per ton as compared to $2 per ton in 1920. The price did not have a very great range except in such points as lower Michigan where the material requires no special preparation. The general inactivity in the iron and steel industries had its effect on the silica sand industry.



Price Range of Slak During 1921

Seasonal Changes

Practically every product with the exception of agricultural limestone showed a steady decline in price as the season advanced. In all probability this was due to the general decline of prices in all commodities throughout the country. Agricultural limestone had some difficulty in finding a level.

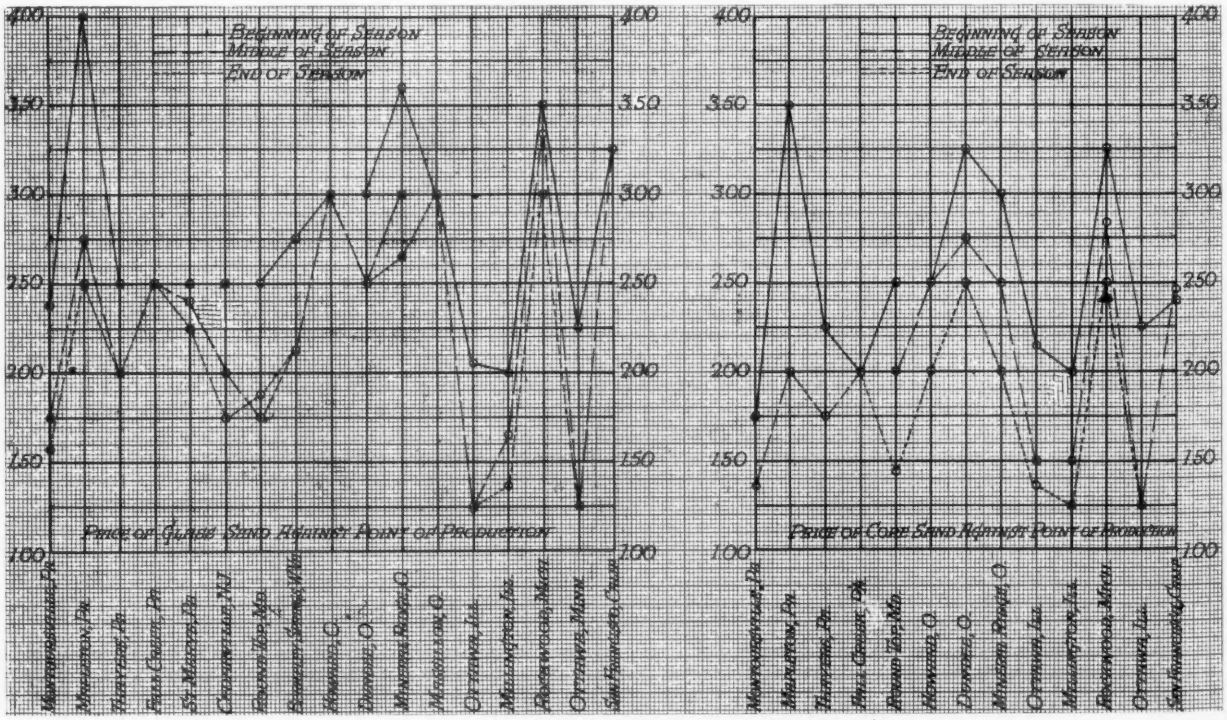
Outlook Seen by Big Quarry Machinery Manufacturer

ONE of the largest manufacturers of quarry, crushing-plant and cement mill machinery views the outlook as follows:

"We have faith that the near future will see a very considerable betterment of industrial conditions throughout the country and we all look to see, by springtime, a return to prosperity.

"We believe that prices have reached about the lowest level they can be expected to and that they will probably remain stationary from now on. We do not anticipate seeing, for quite some time, any of the price levels of eight or ten years ago, and in no case until other conditions approximate that period.

"The year 1921 was fairly good to us and we expect 1922 to be better. We have a number of very important contracts pending, most of which we expect to close. So that altogether things with us, at least, are looking very much brighter than they have for a long time back."


Beginning of Season
Middle of Season
End of Season
Price of Glass Sand Against Point of Production
Price of Core Sand Against Point of Production

Price range of various silica sands during the year of 1921

Minnesota Rates Reduced on Sand, Gravel and Stone

UNDER DATE of December 28, 1921, the Railroad and Warehouse Commission of the State of Minnesota issued the following order in regard to rates on sand, gravel and crushed rock:

This proceeding was originally an informal complaint lodged with the commission by the state highway department, alleging the unreasonableness of the existing rates on road-making materials consisting of sand, gravel and crushed rock.

An informal conference was held in the office of the commission on June 10, 1921, but as no definite results were reached the commission on October 26, 1921, proceeded on its own motion and ordered that a hearing be held on November 10, 1921, and pursuant to this notice the case came on for hearing before the commission, the complainants being represented by Assistant Attorney General Christopherson of Minnesota, sand and gravel producers and officials and experts of their own organization, the respondent carriers being represented by their traffic officials.

From the testimony offered, the commission finds that the present rates on sand, gravel and crushed rock has had the effect of restricting the free movement of these low-grade commodities, and to a certain extent has curtailed the work of building roads in the state of Minnesota;

That on account of the opening of low-grade sand and gravel roadside pits, the carriers have lost considerable revenue which they would have received had the rates on these commodities been such as to allow of its free movement;

That under existing rates the revenue per car derived from the transportation of sand, gravel and crushed rock is entirely out of proportion to the revenue per car derived from the movement of carloads of other commodities of much greater value and liability to damage;

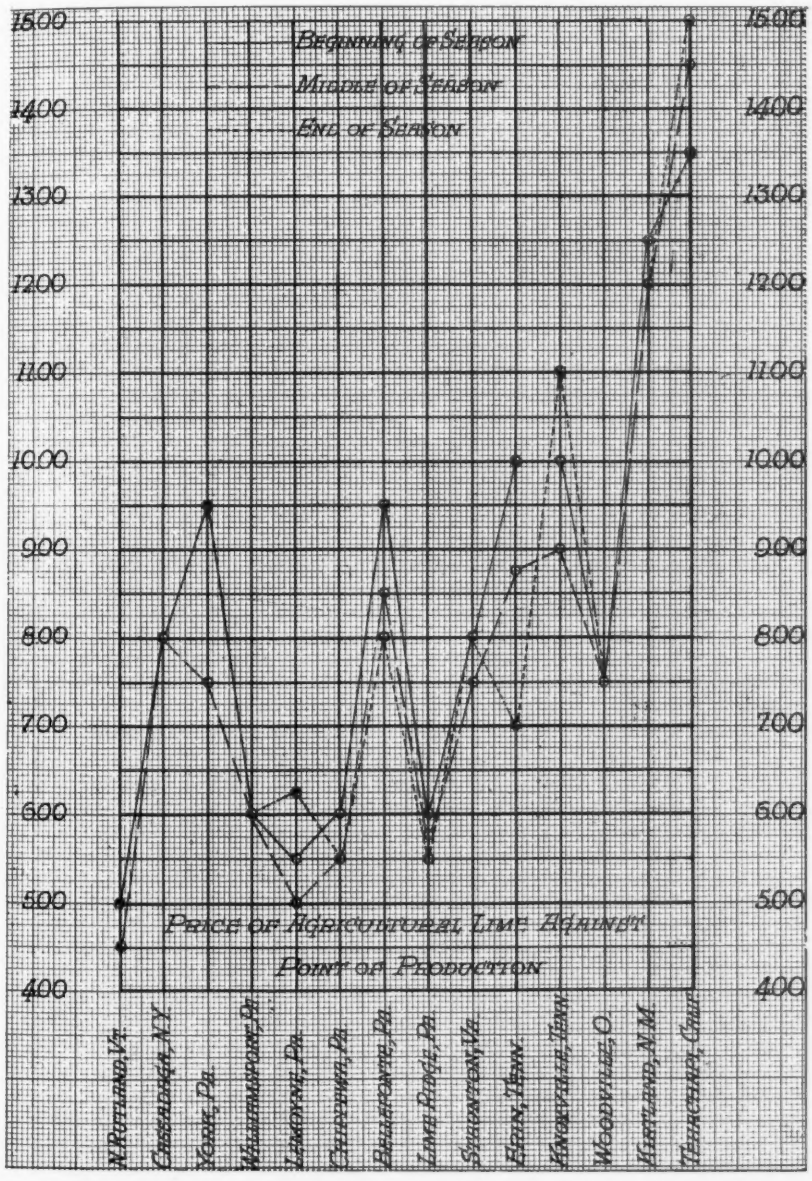
That there are practically no claims for loss of damage on shipments of sand, gravel and crushed rock;

That the record does not furnish sufficient information on which the commission could determine the amount of reduction in operating costs which have been brought about by wage reductions and changes in working conditions, but it is unquestionable that such savings are and will be numerous and should be reflected to some extent in some rate reductions which will allow the free movement of low-grade commodities.

It is therefore ordered, that the respondent carriers on or before January 15, 1922, publish and file with the commission tariffs naming rates on sand, gravel and crushed rock, which shall not exceed the following scale of rates for the distances shown in the following table:

Miles.	Rate.	Miles.	Rate.	Miles.	Rate.
5	2.0	80	4.5	155	6.5
10	2.0	85	5.0	160	6.5
15	3.0	90	5.0	165	6.5
20	3.0	95	5.0	170	6.5
25	3.0	100	5.0	175	7.0
30	3.0	105	5.5	180	7.0
35	3.0	110	5.5	185	7.0
40	3.0	115	5.5	190	7.0
45	3.0	120	5.5	195	7.0
50	3.5	125	5.5	200	7.5
55	3.5	130	6.0	210	7.5
60	3.5	135	6.0	220	7.5
65	3.5	140	6.0	230	8.0
70	4.5	145	6.0	240	8.0
75	4.5	150	6.0	250	8.0

The rate is evidently on a 100-lb. basis.—The Editors.



Price range of agricultural lime at various shipping points during 1291

It was shown that of a total of 1953 cars of sand, gravel and crushed stone—97,810 tons—hauled in Minnesota, paying the railroads $84,190.80, with an average haul of 44 miles, an average loading of 50 tons, and an average revenue per car of $43.10, the average earning per car miles was 98 cents. Also, that of all other classes of freight, the average earnings of the railroads serving Minnesota for hauls of 158 to 335 miles, the average earnings per car mile do not exceed 21 to 27 cents.

Sand and gravel men point to this as showing a decided inequality in the freight rates. Indiana producers assert that almost a similar situation exists in Indiana, although some slight relief was granted recently by a reduction of 14 per cent, but which reduction, it was said, was so inequal that it amounted to zero at Martinsville and 14 per cent in Indianapolis.

Gravel men say this small reduction will not act as an incentive toward road building in view of the fact that many county commissioners have refused to pay over 60 cents a ton freight rate on road materials.

Indiana gravel men will have representatives at the hearing before the Interstate Commerce Commission January 16 and will assist the national association in attempting to secure a reduction for the entire country, basing their protest on such examples as Minnesota and Indiana.

Railways' Plea Against Rate Reductions by States

SOME IDEA of the railways' defense against the petition of the National Association of Sand and Gravel Producers for lower freight rates in the C. F. A. territory, heard by the Interstate Commerce Commission in Washington, D. C., January 16, is given in the following plea of the railways in the general investigation of all rates, now in progress in Washington:

W. C. Maxwell, vice-president in charge of traffic of the Wabash Railway Co., in testifying before the Interstate Commerce Commission concerning the effect upon the business of the railroads of orders by state commissions in reducing intrastate rates in Central Freight Association territory, said in part:

The carriers and this commission have accomplished much in the last five years toward removal of discrimination and toward uniformity in the rates in Central territory, but the orders of the state commissions are destructive of uniformity and prolific in bringing about discrimination.

In Indiana and Illinois the Interstate Commerce Commissions issued orders to remove the discriminaion by making the same advances in intrastate rates that were made in interstate rates. In Michigan and Ohio the state commissions authorized the same increase in rates as authorized by this commission in Ex Parte 74 (the rate increase of August 6, 1920). With eight exceptions, however, the Michigan and Ohio state commissions have reduced the rates on a considerable volume of traffic, which is having a marked effect on the revenues of the carriers and *unless relief is obtained from the Interstate Commerce Commission, the effect will be to break down the interstate rates, which will result in a further loss of revenue to the carriers.*

Sand, Gravel and Crushed Stone

The Michigan Commission issued an order reducing the rates on sand, gravel and crushed stone.

The Ohio Commission had set down for hearing complaint as to the rates on these same commodities, and the carriers offered as a compromise to put in rates on a basis of 115 per cent of the rates of August 25, 1920, subject to the Michigan scale as a minimum. This was not accepted.

Prior to the decision by the Ohio Commission, Governor McCray of Indiana called a conference with representatives of the carriers who offered to put in 115 per cent of the August 25 rates with Michigan scale as a minimum.

However, the Ohio Commission issued an order fixing the rates on the August 25 basis. *This wiped out the entire advance granted by the Ohio Commission in Ex Parte 74 proceedings.*

The Ohio Commission thus fixed rates in Ohio lower than Michigan, lower than the carriers put into effect in Indiana and lower than the interstate rates.

This has resulted in further demands from the shippers in Michigan and Indiana and from interstate shippers.

Action of these commissions resulted in an enormous loss, and will result in further enormous losses of revenue.

For illustration, the loss to the Michigan Central alone on these commodities is $334,000. The reductions on these commodities are largely made through action of the state commissions, and will, in my opinion, represent a loss of millions of dollars to the roads in Central territory.

In Ohio the carriers filed a petition for rehearing which was denied, and they have since applied to the Supreme Court for relief. This will take a long time, and *in the meantime the carriers must suffer.*

Slag: Order 2056 of the Ohio Commission reduced the rates on slag from 4.2 per cent to 23 per cent, an average of 14.9 per cent.

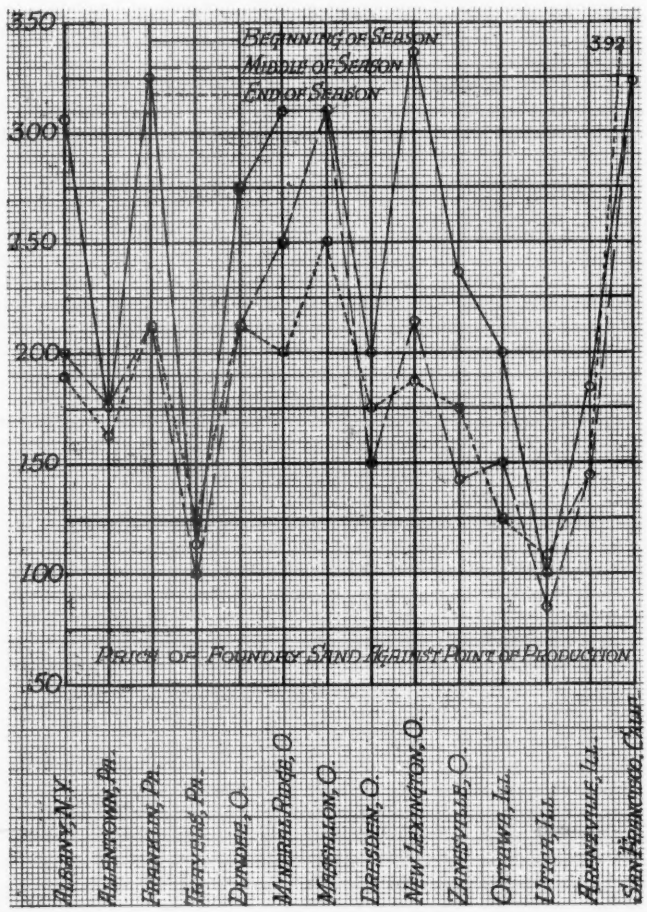
Limestone, Agricultural, Ground and Limestone Screenings

The Ohio Commission eliminated entirely the 40 per cent increase granted under Ex Parte 74 proceedings. This has been followed by a demand from shippers of agricultural lime in Ohio, who desire that the carriers maintain the same relationship between the rates on their traffic and the rates fixed by the Ohio Commission on limestone. Here again the Interstate rates will be affected by the Ohio Commission's order.

The endless chain goes on and continues to work. It is a well-known fact that the transportation conditions are identical in the bulk of this territory. None of the shippers will be satisfied until all rates, interstate and intrastate, are reduced to the lowest rates fixed by any commission.

Graft in Indiana Prevents Increased Use of Road Material

A STATEMENT has recently been issued by Jesse E. Eschbach, chief examiner of the Indiana State Board of Accounts, in which he said that one of the worst grafts in that state was in road construction. He said the men of his department during the past year have found instances where roads and bridges have been built with only 50 per cent of the required material used. His department is preparing to conduct an active campaign during the next year to stop such practices.



Price range of foundry sand at various shipping points during 1921

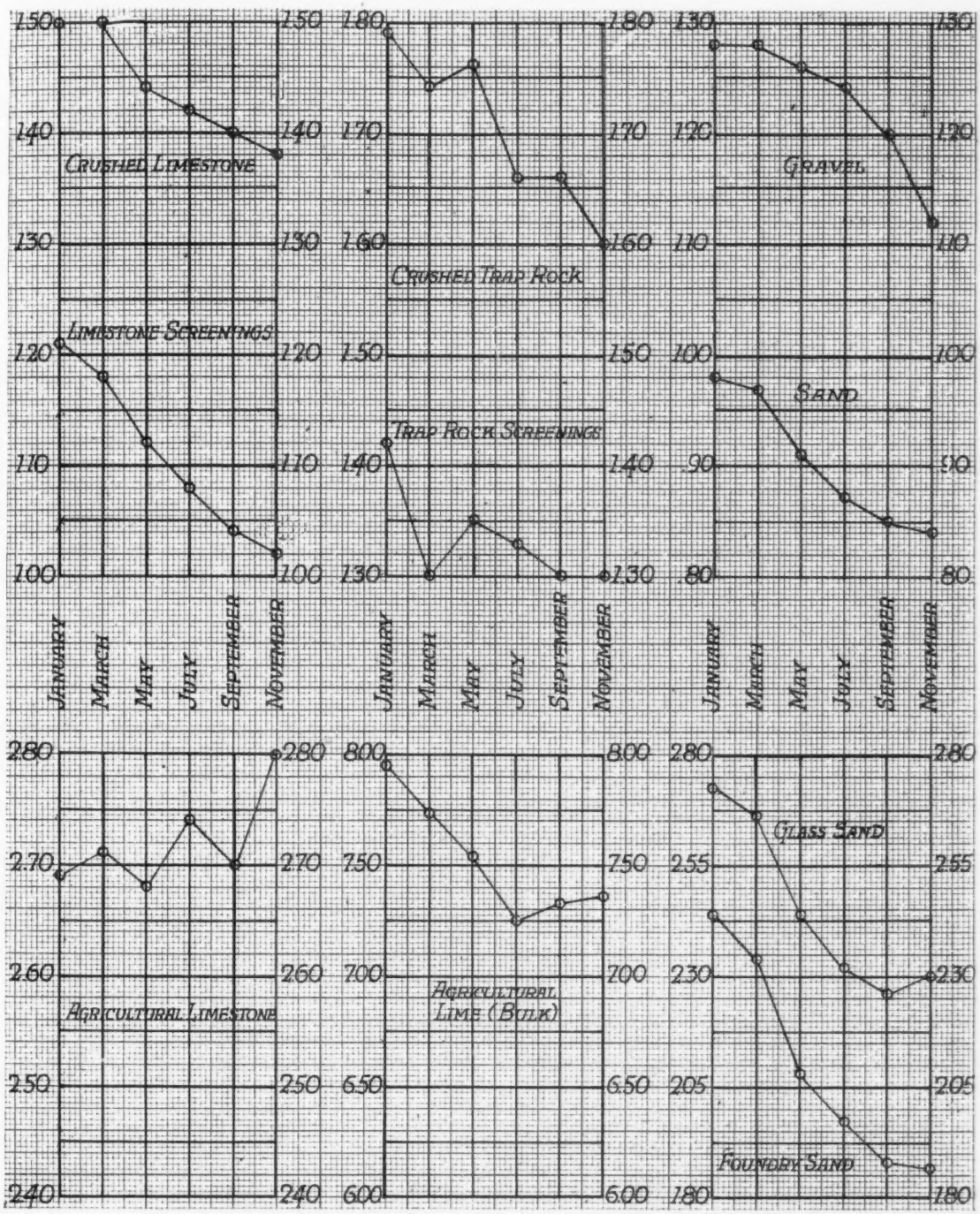
Montana Freight Rates Made Permanent

TEMPORARY freight rates on sand, gravel, crushed and broken stone have been made permanent by the Montana Railroad Commission.

At a recent hearing in Helena, the railroads vigorously opposed the continuance of the temporary rates. Commercial clubs and other civic organizations, however, appealed to the board to sustain the present rates. The board decided that the reduction of 25 per cent, made as an experiment on May 20, was warranted in the face of present conditions.

New Concrete Brick Plant

CONCRETE brick will be manufactured by Edward Smithgall in the plant nearing completion at Mountoursville, Pa. This plant, 50x160 ft. in dimensions, is built of concrete block. The capacity of the plant will be 10,000 brick a day.



Average prices at various seasons of the year for rock product materials during year 1921

A Geologist-Engineer's Analysis of the Situation

Railway Officers and the Public Need Education on Some of the Problems of the Rock Products Industries

By John H. Ruckman
509 Stock Exchange Bldg., Philadelphia

A CERTAIN sand and gravel company in a Southern city has recently completed a large sand-washing plant, costing, I believe, about $200,000. There is another large deposit of sand which is not so easily quarried and has not the same reputation locally, although it is good material. It now costs the sand company 87 cents per ton to deliver in the city yards. It will cost the owners of the other deposit 25 cents per ton to deliver *on the job* by truck. These people have not been able to get capital to put up a washery. When they do I think the railway will lose some valuable freight.

Again, the marl industry of New Jersey is being smothered by rates. The German potash salts with which the marl competes are less bulky. High rates in this case are a direct aid to foreign competition. A small marl company in Virginia has been forced to suspend operations because although its product was a true limestone, the one railroad leading to the plant refusing to allow the agricultural lime rate. Result—the plant shut down. The railway lost the freight.

I recently talked with the assistant vice-president of one of the largest banking and investment houses in New York. He claimed that rates must stay up and that they did not markedly influence the cost of anything. He chose as examples such things as hats and automobiles. I suggest that here is a chance for education. I suggest that somebody figure out the cost of some structure—say, a common large brick and steel building—and then figure the freight on the steel, the brick, the cement, the sand and gravel, the stone, tile, etc. Then figure the freight on the iron ore, the coke, the limestone to make the steel; then the coal that burned the brick, cement, tile, etc. Then figure the freight on coal and supplies at the iron and coal mines, the overhead of the steel mills and the part played there by freight as a factor in first cost, etc. I think that such a study will go a long way toward a better understanding of the effect of freight rates on industry and the cost of living.

I had the pleasure of hearing a very prominent Eastern railway official give an informal talk to a group of business men. He was far from optimistic over the entire situation. He said that he realized fully that the present rates were strangling certain industries, but that with lower freights it was almost if not quite impossible to run roads such as his (those with large seaboard terminals) at a profit. After listening to him and to the discussion that followed I began to feel that it was perhaps possible that we are asking too much of our roads. In Europe sand, gravel, stone and ore are always shipped by water. It is slower, but it is cheaper; it tends to stabilize the industry and relieves the railways, permitting them to carry only fast freight, for which they can obtain a high rate.

Another solution is the development of local washeries. Plain dirt, if properly treated, can be separated into fair building sand and brick clay. This does not pay unless the freight rate to the next good deposit is higher than the cost of washing.

Specifications—I suggest that the American Society for Testing Materials might do well to take up the question of concrete agglomerates with a little more interest and find out something which could be regarded as official. The writer has his own ideas on the subject; so has every other engineer in the country. For road work Pennsylvania specifies cracked rock. New Jersey specifies gravel. Both when properly handled seem to give excellent results. To make the matter a joke it has been decided that one fresh fracture on a rock means that it is cracked rock. New Jersey quarries can install stone crushers, crack their larger pebbles and sell their material for work in Pennsylvania, although the qualities of the material cannot have been greatly changed.

As to roadside agglomerates, it depends on the roadside. If you are blasting your way through trap or limestone, why not use it? Failure to do so means increased costs, increased taxes, increased rents, increased living costs, increased wages and decreased profits for everybody.

What is needed is research as to agglomerates, a standard specification by the American Society for Testing Materials or the American Society of Civil Engineers. Then follow the specification.

Business and Unemployment—When a period of deflation sets in, losses (on paper) are nearly unavoidable just as huge profits can scarcely be prevented during a period of inflation. Those who have taken their losses are now ready to profit by increasing demand. Those who refuse to take their losses now will take them later, willy nilly; to see a good example note the relative policies and the results in the case of the Ford Motor Co., which took its losses early, and of some others, which tried heroically to dodge them altogether. The quickest way to get back to normal is to reduce prices even if this reduction entails running at no profit or even a loss. Most rock products have already receded. Bituminous coal has dropped. Steel has dropped some. Now it is up to the railroads and to certain classes of labor.

Reduction of unemployment is, in my opinion, impossible unless the laborers are willing to take reductions. They can hardly afford to do so unless rents are lowered. I am inclined to believe that rents will soon be lower from the sheer inability of landlords to find paying tenants.

If the men will work at lower wages then all state and municipal contracts should be let at once and work rushed throughout the winter. Mr. Hoover's suggestion regarding repair work is also excellent. Some practical method of raising the money, however, is in order. The railways alone have enough deferred maintenance to keep the whole unemployed of the country busy all winter, but they can do nothing until the "National Agreements" are abrogated, and until they can get money or credit to do the work. Production for future demand, unless it can be accomplished at very low cost, does not impress me. Inventories are still very large. When they are reduced, production will come on rapidly.

There is at present a heavy demand for dwellings. If a method of construction can be devised which will permit six-room houses to be built at a price which will permit rents of $30 to $40 a month, it seems that such construction should begin at once and will soon bring along a general revival. There is no use in trying to build at prices which necessitate rentals of $60 to $100, as is now the case.

Panorama of quarry and cement plant, Petoskey, Mich. Looking east from lower end of quarry

Wet-Process Cement Plant Operated Entirely with Waste Heat

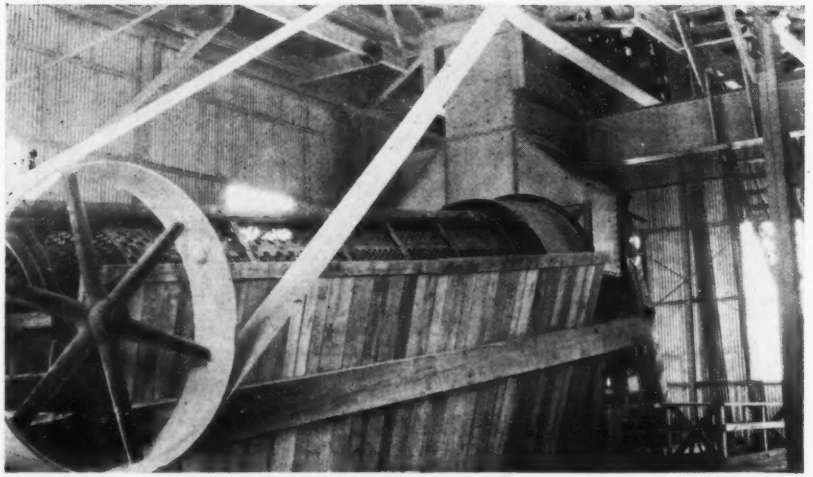
Petoskey Portland Cement Company Has Had Spectacular Success from Its First Day of Operation

THE FIRST wet-process portland cement plant in the world to be operated entirely from power generated by waste heat from the kilns is that at Petoskey, Mich., completed and put in operation in March, 1921. It is also one of the first portland cement plants in the world designed for waste-heat utilization as a part of the original plans instead of as an afterthought. The Petoskey plant is also a most notable wet-process plant because it possibly marks the end of the trend toward longer and longer kilns, and is a return to the 150-ft. length as the most economical under present conditions —under conditions that make it necessary for the wet-process as well as the dry-process plant to utilize waste heat. In other words, its successful operation means somewhat of a revision of former theories and practice.

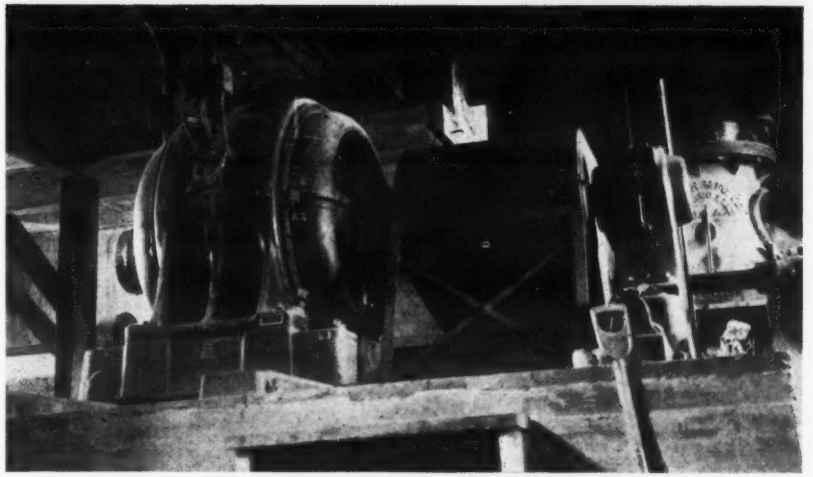
History of the Company

The Petoskey Portland Cement Co. is the outgrowth of an old and well-known crushed-stone operation. For years this quarry has supplied the limestone used at

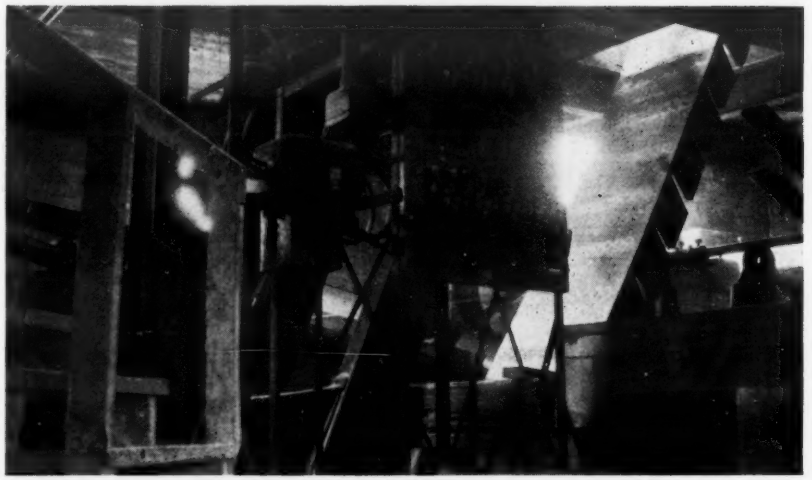
Plant from quarry, with coal mill in the foreground



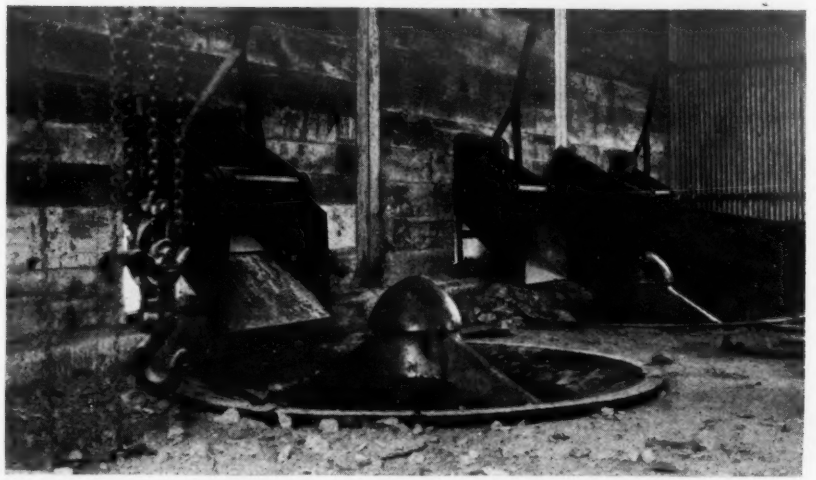
Screens in place showing drives from rope-driven counter shaft—crushing plant



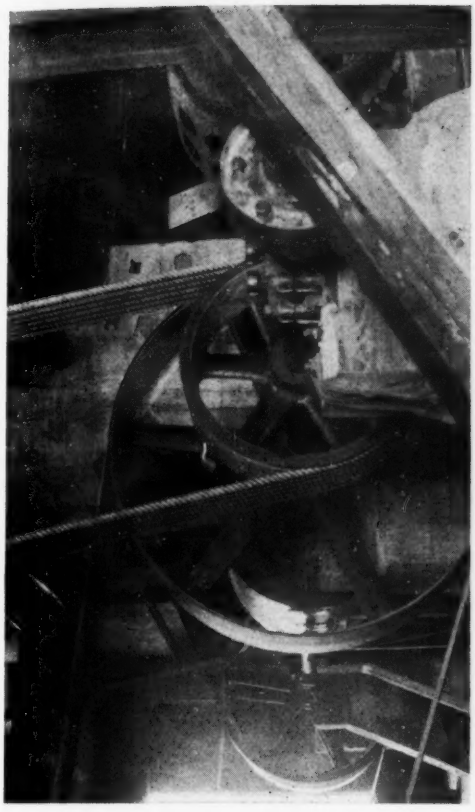
This 400-hp. motor runs the whole crushing plant



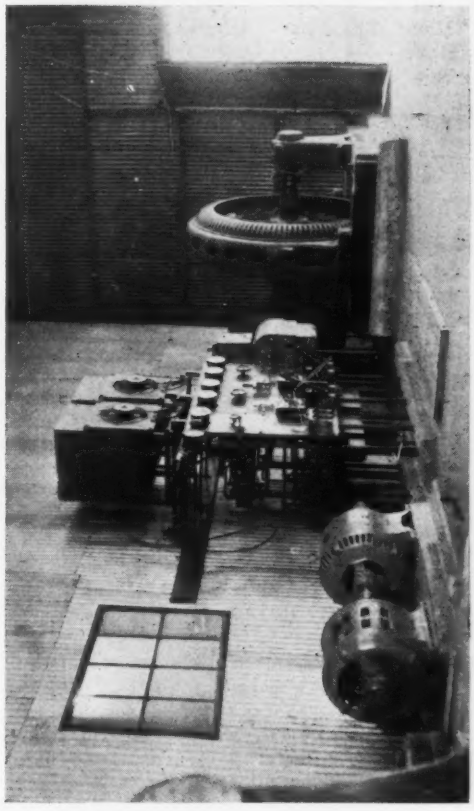
Crushing-plant motor-control apparatus



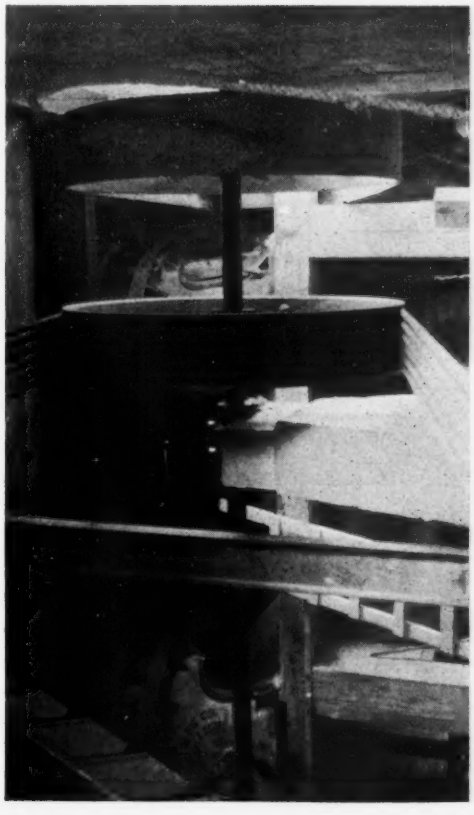
Battery of No. 5 re-crushers fed from bins



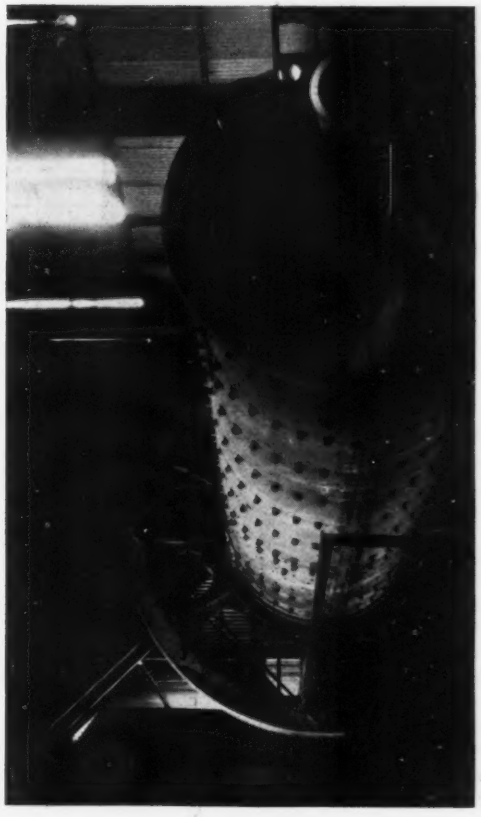
Silent-chain drive on main shaft and rope drives on screens—crushing plant



Synchronous motor driving compeb mill through a magnetic clutch

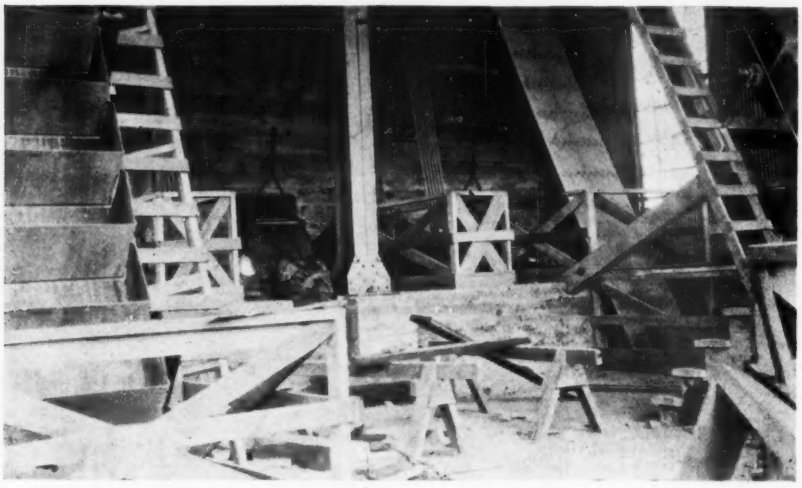


Balanced drives. Belt on No. 5 crusher, rope on No. 12 crusher



The 7x22-ft. compeb mill grinding slurry

the Newago Portland Cement Co. plant at Newago, Mich. The stone is a very pure high calcium rock, similar chemically to the famous deposits near Rogers City, but much harder. Stone from the same deposit has been used to make high calcium lime for many years.



Interior of crusher house showing two No. 9 bucket elevators—crushing plant

The stone at Petoskey is near the water front on Little Traverse bay and the quarry site offered exceptional shipping facilities. The company holdings include 400 acres and 2½ miles of shore line.

The cement company was promoted by local interests. A. B. Klise of Petoskey is president and John L. A. Galster of Petoskey is secretary and treasurer. Early in the organization J. C. Buckbee, of the J. C. Buckbee Co., engineers, Chicago, was made vice-president and chief engineer in charge of design and construction, and J. B. John, vice-president and general manager of the Newago Portland Cement Co., was made vice-president and general manager in charge of operation of the new plant in addition to his duties at Newago. Through the hearty collaboration of Messrs. Buckbee and John, the company has undoubtedly produced one of the most up-to-date cement plants in the world.

Quarry Operation and Crushing Plant

The Petoskey plant is built on the very rim of the limestone quarry. The cement plant is built approximately parallel to the water front east and west, with the crushing plant at the west end, about 1500 ft. distant from the raw-grinding end of the mill. The quarry is in the rising ground south of the plant site and extends the full length of the plant, with an average height of face of about 35 ft.

Gasoline-engine operated well drills are used for blast holing. Stone is loaded into 7-yd. side-dump contractor-type cars by two steam shovels, one 70-ton and one 85-ton. Forty-ton standard-gage locomotives are used to haul the rock trains from quarry to crushing plant. The trains come out of the quarry at the west end, near the crushing plant, on a 2 per cent grade and are pushed back to the crusher on a switchback.

The crushing plant would be a notable one in any commercial operation. For a daily capacity of approximately 2500 tons it is remarkably compact and well arranged. It is only 48x100 ft. in plan, and is built throughout of concrete and structural steel.

Dumping platform at initial No. 12 crusher. Note counter for cars of rock

The initial crusher is a No. 12 Gates. The cars dump into it from a track passing through the side of the building. The crusher discharges to either one or both of two No. 9 belt-and-bucket elevators. These elevators discharge at the top of the plant to four 60-in. x 22-ft. cylindrical screens, arranged in pairs.

The oversize from the ends of the screens falls into storage bins, where it may be shipped out as flux stone, or for some other purpose requiring large sizes, or may be fed from the bins to a battery of four No. 5 gyratory crushers. These crushers are arranged in a row on the same floor level as the primary No. 12 crusher. The No. 5 crushers discharge to the same two No. 9 elevators serving the No. 12 crusher, by means of belt conveyors below the crusher floor level.

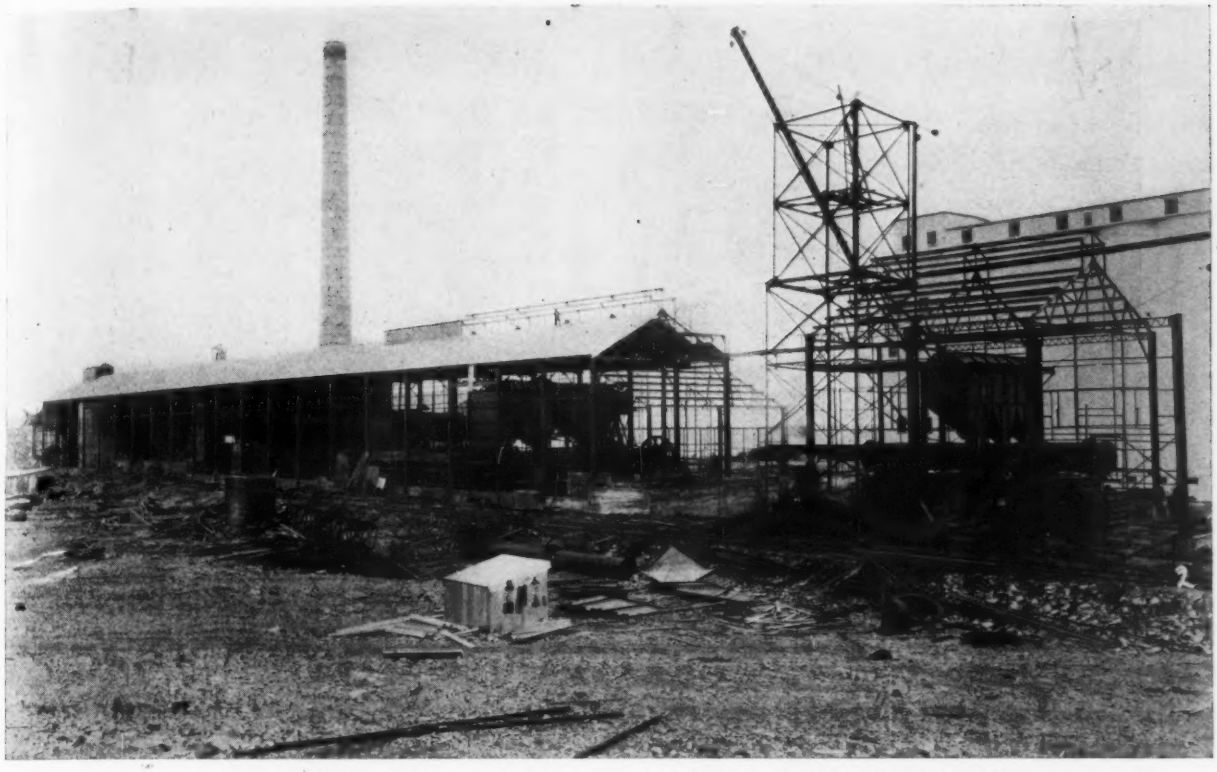
The compact arrangement of crushers and elevators makes it possible to drive the entire crushing plant with a single 400-hp. motor, running at 440 r.p.m., on a 2300-volt, 3-phase, 60-cycle a.c. circuit. All the machinery is driven direct from a main shaft, to which power is transmitted from the motor by a Link-Belt silent chain drive, being the first such installation of note in a stone-crushing plant. The screens are driven by rope drives from the main shaft. The No. 12 crusher also has a rope drive.

The storage bins have 12 compartments with a total capacity of 1600 tons. Underneath are three loading tracks. Stone for the manufacture of portland cement is transported to the mill in standard-gage railway equipment.

General Plan of Cement Mill

The layout scheme of the cement plant is very simple. Stone and shale are brought to a storage pile at one end, coal to the other end. The raw materials and the coal come together in the kilns in the middle of the plant. The clinker is discharged, passed to storage, or ground, and the finished cement is conducted to an adjoining building where it is stored, bagged and shipped.

The waste-heat boilers are at the ends of the kilns, near the middle of the plant, and the power plant is in a building, immediately adjoining on the north side of the mill building.



Plant at Petoskey before completion showing relation of coal mill to kilns and coolers

The raw-grinding, slurry tanks, waste-heat boilers, kilns, and clinker-grinding departments are all under one roof in a long, rectangular building, 50x500 ft. in plan. The coal mills are in a separate building, 50x72 ft. in plan, and 50 ft. distant from the east end of the main building.

Raw Material Handling and Grinding

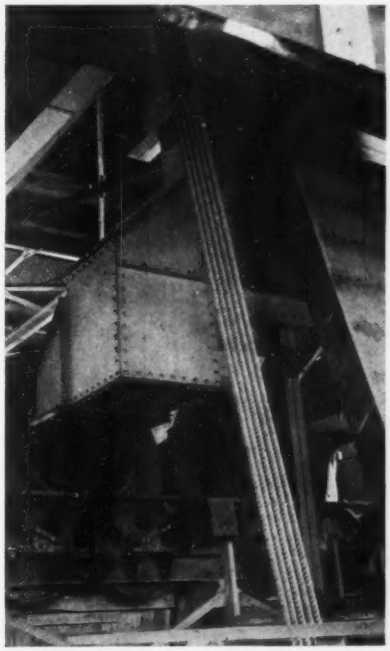
Crushed limestone, and shale from a quarry some 18 miles distant, are dumped from a trestle on ground storage piles over a concrete tunnel. The two ingredients are fed from these storage piles through openings in the roof of the tunnel, 15 ft. apart, into traveling measuring hoppers, which are moved on rails, straddling the belt conveyor. The proportioning is done as the materials are drawn.

The 24-in. belt conveyor, under the ground storage, discharges to a No. 6 belt-and-bucket elevator, which empties into two 500-ton steel storage bins.

Each bin feeds a 7x22-ft. compeb mill. The compeb mills are connected through a single countershaft, with a magnetic clutch, to 400-hp., 2300-volt, 3-phase, 60-cycle Allis-Chalmers synchronous motors, operating at 180 r.p.m.

The magnetic clutches permit the motors to start under no load and pick up the mill afterward, or the mills can be stopped by simply throwing out the clutch. The clutch is operated by throwing a small knife-switch and the operation of a small rheostat.

The two motors are housed in a room or compartment separated from the mills.



Elevator discharging into pair of 60-in. x 22-ft. screens — crushing plant. Note housing of chutes, rope drives, etc.

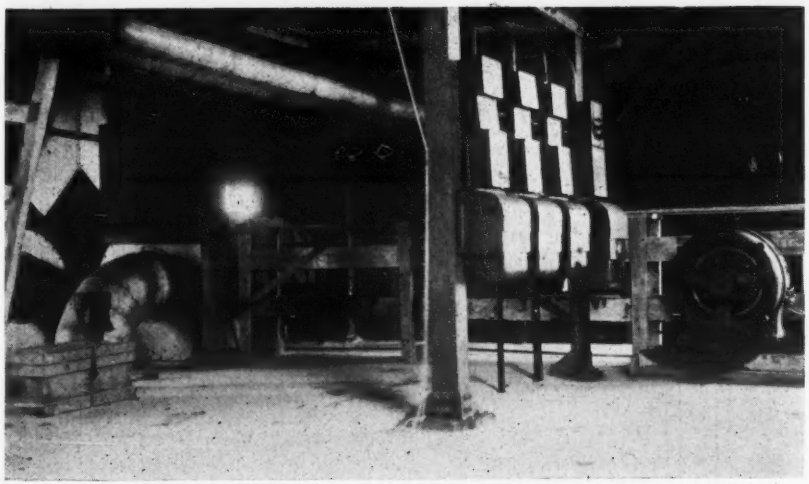
In this room are also housed the controlling switchboard for the motors and a 25-kw., d.c. motor-generator set for supplying the exciting current for the synchronous motor fields and the magnetic clutches.

Slurry Handling

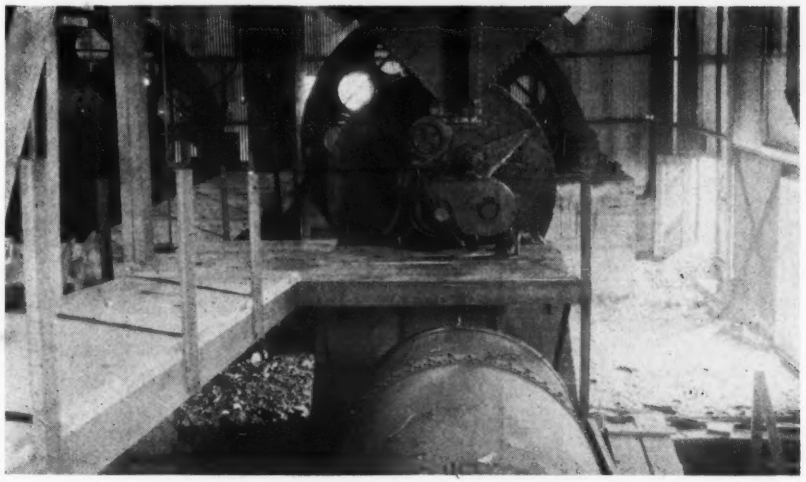
Below the floor level of the room containing the two compeb mills and under the discharge ends of the mills is a 6x30-ft. concrete tank, or pond, into which the compeb mills discharge. This allows thorough mixing of the product of the two mills.

A compressed-air pump of the displacement type (air-lift) transfers the slurry from the pond to any one of six correcting tanks. These tanks are made of reinforced-concrete and are 20 ft. in diameter by 40 ft. high—each holds slurry enough for 1000 bbl. of cement. The slurry is continuously agitated in the tanks by compressed air.

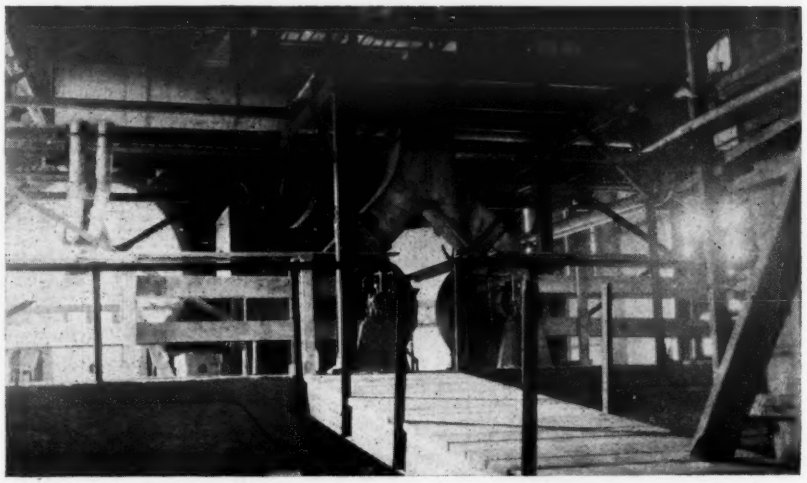
The six correcting tanks are so connected with a second compressed-air operated pump that slurry may be transferred from any one to all the others. The same pump is used to remove the finished slurry from one or more of the six correction tanks to one or both of two 20x20-ft. reinforced-concrete tanks under the feed ends of the two kilns. From these tanks a third compressed-air operated pump delivers the slurry to the feed troughs of the kilns. These two kiln-



Motor and control apparatus for fuel feeding at kilns

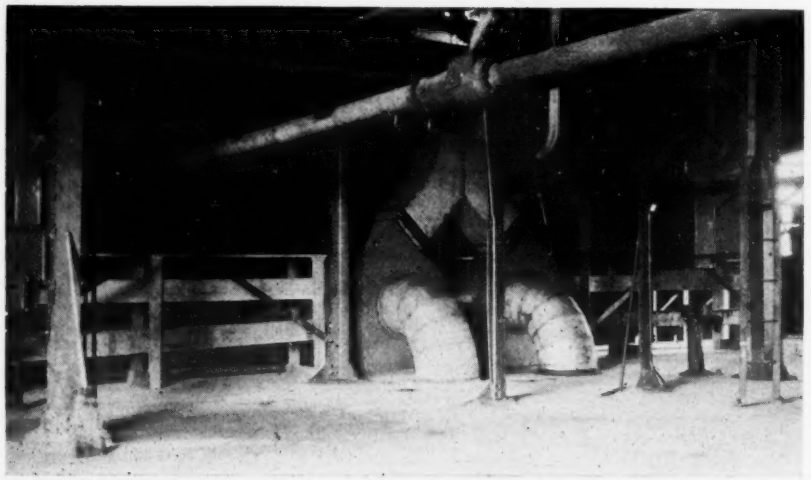


Cooler ends and compeb-mill feeds

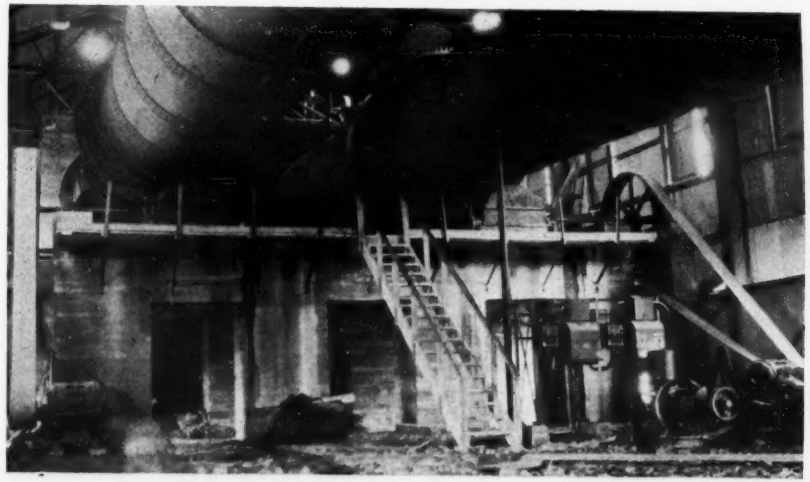


Firing floor of kiln from the compeb mills

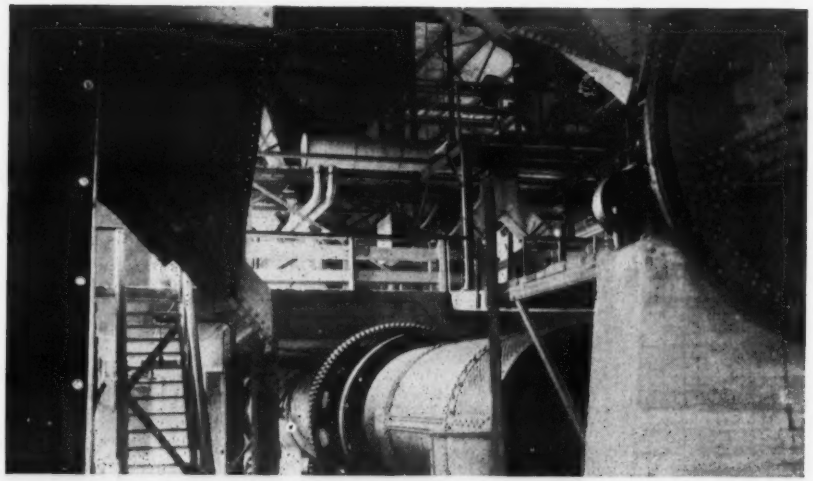
Peck carrier for clinker handling and storage—south side of mill



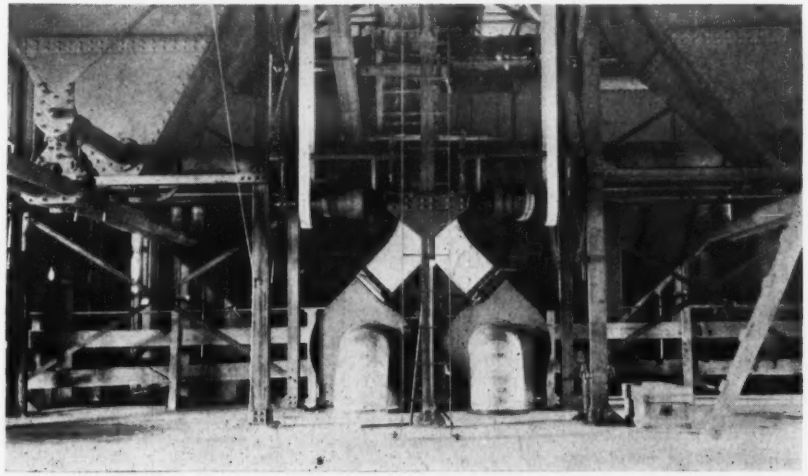
Pulverized coal injector for one kiln



Kilns from below showing motor drives and control



Coolers, end to end of kilns, looking back toward firing floor of kilns. Gypsum tank and feeding spout in the left foreground



Firing floor of kilns showing pulverized coal injectors, blowers and pulverized coal bins

feed tank may be bypassed and the slurry pumped direct from the correcting tanks to the feed troughs of the kilns, using the pumps at the six tanks.

Kilns and Coolers

Between the six slurry tanks and the kilns are the waste-heat boilers. A passageway on either side leads to the kiln room, where two 10x150-ft. kilns are mounted on parallel axes. An elevated passageway is provided between the two kilns.

The kilns discharge by gravity direct to two 6x60-ft. rotary coolers, placed end to end of the kilns, on parallel axes. The ends of the coolers are under the concrete firing floor of the kilns, and every effort is made to conserve the heat during the transfer of the clinker from the kiln to the coolers.

Air seals are provided on the upper ends of the coolers and angle-iron rings are placed around the lower ends of the kilns to run close to the hood in order to reduce any infiltration of cold air. Air for combustion in the kilns, other than that blown in with the fuel, is drawn through the coolers. Air seals are also provided at the feeding ends of the kilns to prevent infiltration of cold air into the gases going to the boilers.

The kilns themselves have their brick linings insulated from the shells with sil-o-cel, for the entire length, except about 10 ft. at the feed ends, and the firing zones which have to be replaced frequently.

The success of the waste-heat installation in this wet-process plant is in no small measure due to this conservation of heat in every detail. The temperature of the flue gases as delivered to the boilers is about 1100 deg. F., which is as high as the flue gases at the boiler in many dry process plants.

Each kiln has two pulverized coal burners, side by side. These take fuel from two steel bins above the kiln-firing floor, each of 12 tons' capacity. These bins are set back about 30 ft. from the kiln hoods. The powdered coal is drawn by a 4-in. screw conveyor operated through bevel gearing and a system of cone pulleys, so as to give elasticity in the amount of feed.

Compressed air for the burners is supplied by two Bayley multi-vane fans each driven by a belt from a 40-hp. motor on the firing floor of the kilns. One fan is sufficient for both kilns, the other being merely for reserve.

Large sliding doors are provided at the firing floor of the kiln rooms, on both sides of the building, which give light and ventilation. From the kiln-room floor one can look out upon Lake Michigan—certainly unique working conditions for a cement plant employe.

Crushing plant and railway loading bins

Clinker-Grinding Mill

The clinker from the ends of the coolers falls through a hopper-shaped feed chute to a 24-in. Peck carrier, running longitudinally across the ends of the coolers, which discharges the clinker about 40 ft. above, into two bins feeding two compeb mills.

The same carrier may be used to take the clinker to a ground storage pile outside the building. This is done by extending the carrier on an overhead bridge on the quarry side of the mill. The clinker is recovered from ground storage by tapping the pile from below into the tunnel containing the returning carrier. This arrangement is very simple and flexible and permits the compeb mills to be filled either with fresh clinker, storage clinker, or any combination of the two.

Ordinarily the clinker discharged from the coolers is sufficiently cooled to run through the mills. When it is not it is water cooled from a spray just inside the discharge end of the coolers. It was found that these sprays had no effect on the kiln drafts, nor operation. The coolers are lined with firebrick but are not provided with shelves or lifting vanes.

The steel bins feeding the compeb mills are of about 500 tons' capacity. Special attention was paid to the housings around the Peck carrier discharges to eliminate dust. Indeed this plant is as near a dustless cement plant as any ever visited by the editors.

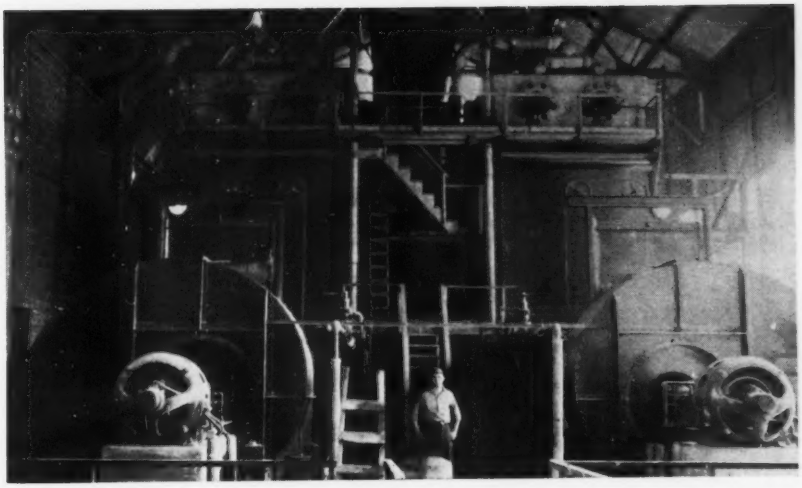
The clinker-grinding end of the plant is a duplicate of the raw-grinding end—two 7x22-ft. compebs driven by separately housed motors, of the same type, size and control as the slurry mills.

Raw-material storage end of mill (west end)

Gypsum Feed

Gypsum is received on the north side of the building (side opposite the clinker storage), and is conveyed direct from a track hopper by a belt conveyor in a concrete tunnel to an elevator boot inside the mill building. This elevator deposits the gypsum into a screw conveyor which in turn discharges to a steel bin about 40 ft. above the floor. This bin holds about 60 tons and is located in line with and alongside the clinker bins. Gypsum is fed out of the bin automatically to the Peck clinker carrier on its way to the compeb-mill bins.

If it is desired to store gypsum beyond the capacity of the feeding bin, it is taken by another screw conveyor from the top of the elevator to a concrete storage bin 20 ft. in diameter by 35 ft. high, on the north side of the building. The gypsum is withdrawn from this bin by gravity to the same belt conveyor which serves the track hopper.



View of Edge Moor waste-heat boilers

Conveyor bridge carrying screw conveyor for finished cement—compebs to stock house—coal mill in the rear of main mill building

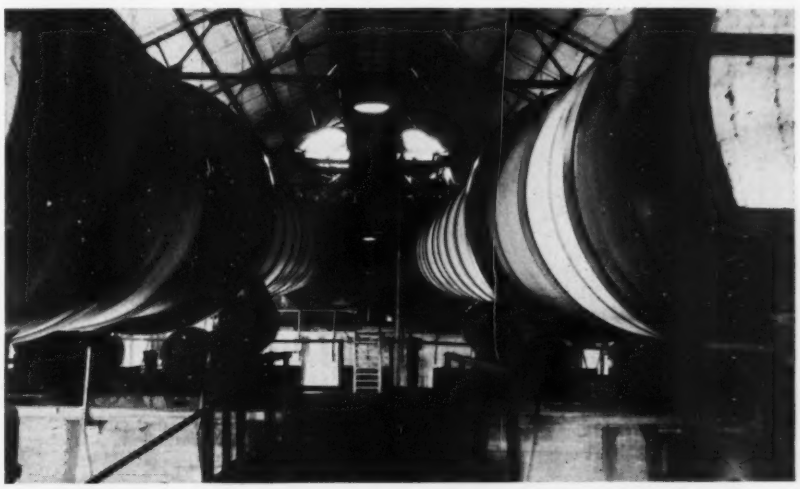
Handling, Storing, Shipping Cement

The compeb mills discharge the finished cement through a closed chute to a 14-in. chain type bucket elevator, located midway between the two compebs, and enclosed in a concrete casing. A 16-in. screw conveyor 50 ft. above the compebs takes the cement across a steel bridge to the stock house and silos, about 100 ft. north of the east end of the mill building.

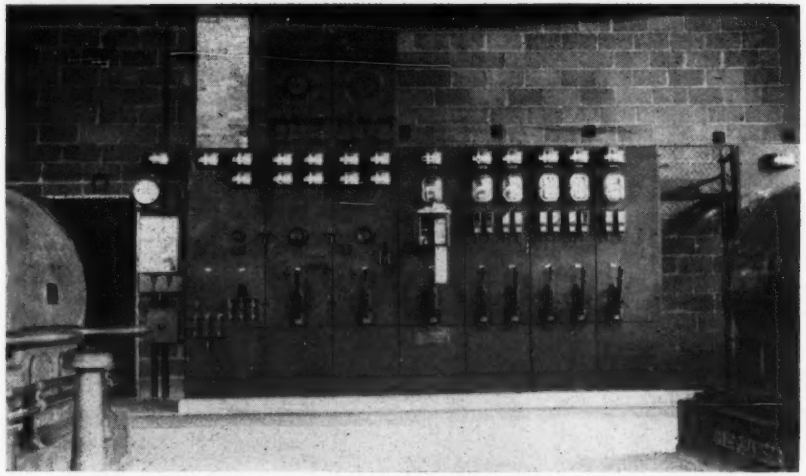
The reinforced-concrete stock house has a capacity of 100,000 bbl. There are six cylindrical bins each 32 ft. in diameter and 71½ ft. high. The interstices between the bins provide additional storage space. Also the interstices between adjoining bins and the outside walls are so utilized, making six cylindrical bins and seven interstice bins. In this way practically the whole ground area of the stock house is used for storage purposes.

The west end of the stock house, 20x54 ft., is the packing plant. On the ground floor are Bates valve-bag packing machines. On the second floor are the bins feeding the packing machines, on the third floor the weighing devices for shipping bulk cement, on the fourth floor the screens for preparing the cement for the bag fillers and on the fifth floor, which is level with the tops of the silos, are the elevator heads and screw conveyors for distributing the cement to the storage bins.

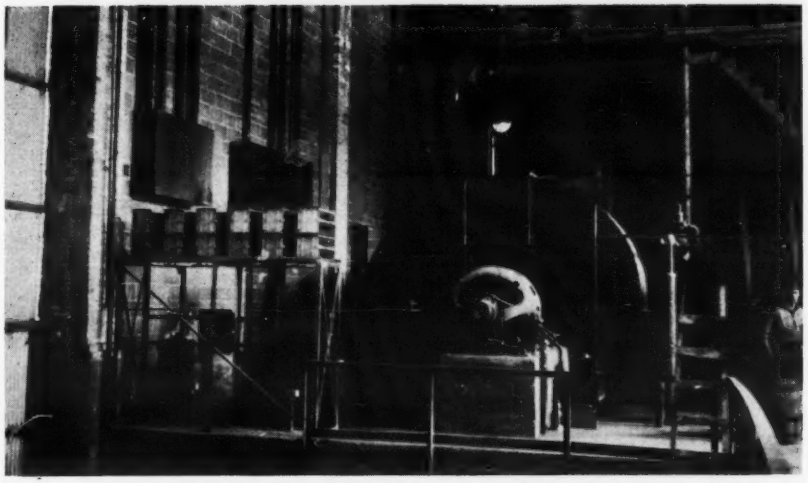
Two lines of screw conveyors in a pent house 38 ft. wide by 9 ft. high, extending the length of the row of bins, distribute the cement to any of the six bins or seven auxiliary bins. The cement is received from the mill on the third floor, where it is transferred to a 14-in. bucket elevator. The two 16-in. screw conveyors



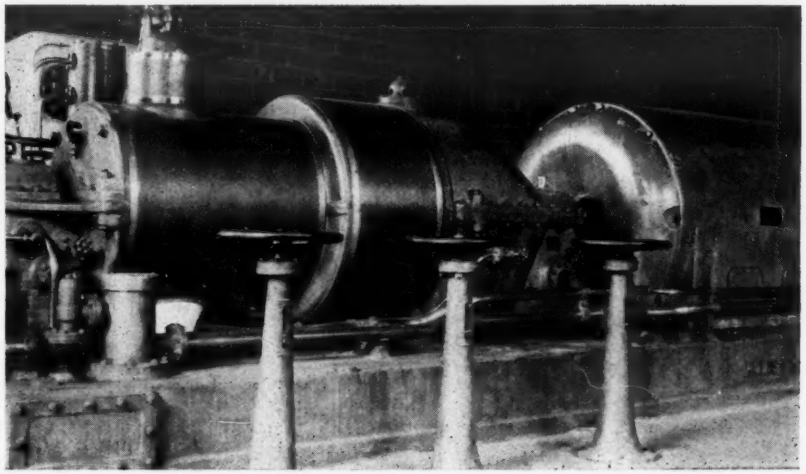
Looking toward the feed end of two 10x150-ft. kilns. Note overhead runway carrying all electric power cables



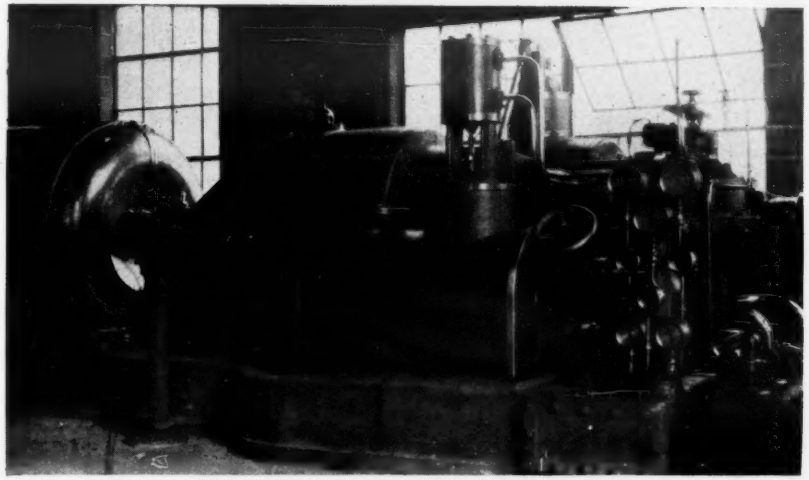
Black-slate switchboard in turbo-generator room



Draft fans on kilns showing motor control and waste-heat boilers



Turbo-generators showing steam-control valves



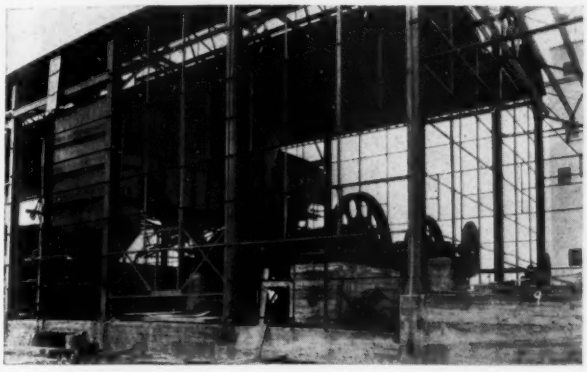
Turbo-generator set in electric-power house

over the bins are cross connected by a third 16-in. screw.

Cement is removed from the bins through 24 openings in the bottom of each bin. There is an 8-ft. basement, with windows on all sides, under the entire bin structure, giving access to any part of any bin. From the bin openings the cement is chuted to one of four lines of 12-in. screw conveyors, which discharge to two lines of 16-in. cross conveyors, under the packing room. These discharge into a 14-in. bucket elevator which feeds the screens above the packing-machine bins.

Each packing machine is provided with a 30-in. belt conveyor to take the loaded bags to cars on tracks either side of the stock house.

At each side of the stock house, at the packing-machine floor level, is a concrete platform 7 ft. wide, parallel to the loading tracks, extending along the side of a 67x 96-ft. building, used for cleaning and storing bags. A concrete block wharf extending 400 ft. out into the bay provides facilities for water shipment.



Battery of compeb mill feed bins and compeb mills

Another view of stock house and packing plant

Waste-Heat Boiler Plant

The two boilers for utilizing the waste heat of the kilns are placed at the feed ends of the kilns, and on the same center line as the kilns. They are the Edge Moor waste-heat type.

The kiln housings and connecting flues to the boilers are constructed of reinforced concrete, lined with firebrick and insulated with sil-o-cel brick between the firebrick and the concrete.

The two draft fans discharge into a brick-lined tunnel below the boiler room floor which conveys the gases to a similar cross tunnel passing under the kiln housings and thence on to the base of a 10x 200-ft. concrete stack located just outside of the mill building. Means have been provided for passing the gases from the kilns directly to this stack and shutting off the entire waste-heat boiler installation conveniently at any time it became necessary or desirable to do so.

Each boiler is equipped with a Green fuel economizer and 75-hp. fan. The motor control apparatus on the fans permits a variation in speed of 30 per cent, so that the draft on the kilns may be regulated within a wide range.

The boiler room floor is about 10 ft. above the basement floor level, which provides ample space below the flues, boilers and economizers for brick-lined concrete hoppers in which the dust carried over from the kilns is deposited. The amount of dust made to date in this mill is surprisingly small, as will be appreciated when it is stated that one man with a wheelbarrow takes care of all the dust in a few hours out of the day. This dust is drawn from the aforementioned hoppers through suitable gates and at present merely wheeled out into the yard, as means have not yet been provided for returning it to the kiln feed. The company contemplates providing apparatus in the future for mixing this dust into a slurry and then returning the slurry to the kilns.

Venturi meter for boiler feed water

Power Plant

The turbine room is a concrete and steel structure located adjacent to the waste-heat boiler room. It is equipped with two Allis-Chalmers 1250 k.v.a., 2300-volt, 3-phase, 60-cycle, 3600 r.p.m. turbo-generators, with jet condensers located immediately below the turbines, having steam-driven air pumps and electrically driven circulating pumps. The cooling water for the condensers flows by gravity from Little Traverse Bay through a concrete tunnel to the cold well below the condenser room floor and the discharge from the condensers flows from the hot well back to Little Traverse Bay through a 24-in. reinforced concrete pipe laid beneath the yard level.

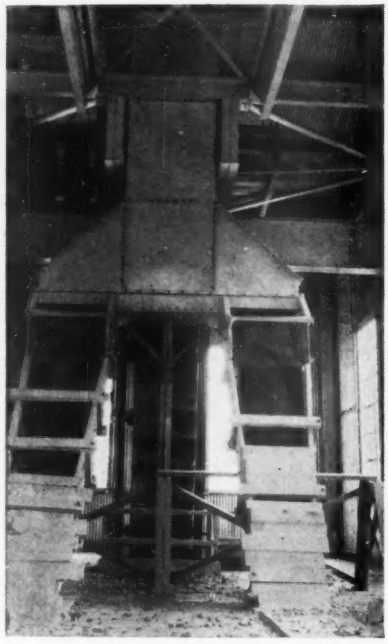
The length of the steam line from the waste-heat boilers to the turbines is unusually short and long radius pipe bends have been employed throughout in place of elbows, as a result of which there is an unusually small drop of both steam pressure and steam temperature between the boilers and the turbines. The boilers were designed for 170 lb. steam pressure and 100 deg. superheat, and it was expected that there would be sufficient steam to run the entire works by carefully balancing the various loads throughout the day and night shifts. In operation, quite a little excess steam has been produced to date; in fact, so much that the blowing of the safety valves became a nuisance and mufflers have been installed. It has further been found that the superheat in the steam averages better than 125 deg., which contributes to economy in the turbines and helps to ex-

plain the excellent results secured by the plant.

The turbo-generators are controlled from a black slate panel switchboard having separate panels for the exciters, each of the generators, the raw compeb mills, finishing compeb mills, crushing plant, small motor transformers and lighting system. The 2300-volt current from the generators is reduced to 460 volts by three 333 k.v.a. transformers located in the basement of the power house for serving the smaller motors throughout the plant. The 460-volt current is distributed through a separate switchboard alongside of the 2300-volt board on the main floor of the station. All motors of 50 hp. and less throughout the plant are operated on 460-volt pressure; all larger motors on 2300-volt current. The distribution of current throughout the mill is carried out by three conductor cambric insulated cables carried in iron conduit to main distributing centers and thence to the various motors through rubber covered wire carried in iron conduit. The power distributing system for the entire mill building is carried under the peak of the roof and is accessible by a structural steel walkway the entire length of the structure.

In the basement of the power house there are also located two 12x10-in. Ingersoll-Rand motor-driven air compressors for furnishing compressed air at 100 lb. pressure for the handling and agitation of slurry in the mill, one of which compressors is automatically started and stopped with the variation of pressure and the other equipped with a suction governor. In the turbine station basement there are also two 12x7x12-in. outside packed plunger feed pumps, and two 12x10x12-in. piston type service pumps for general water supply, all of which pumps are equipped with Fisher pump governors controlling them automatically. Directly over the feed pumps on the main floor of turbine station is located a Cochran open-type feed-water heater which receives the exhaust steam from the condenser air pumps, feed pumps and general service pumps and raises the temperature of the feed water going to the waste-heat boilers to about 200 deg. F.

On the main floor of the turbine station there is a slate switchboard completely equipped with temperature and draft controlling instruments serving the waste-heat boiler plant, also the recording and indicating instrument of a Venturi meter which measures the feed water going to the waste-heat boilers, and, from the readings of these instruments, as well as those on the electrical switchboard, a complete log of the operation of the plant giving hourly readings is turned in by the operating engineers to the superintendent at the close of each day.



Screen side of elevator discharge before screens were placed — crushing plant

The turbine station is served by a hand-operated traveling crane. An interesting feature in connection with the turbo-generators is the provision in the air ducts for drawing air into the generators from the outside or from the basement, as weather conditions require, and for discharging the heated air from the generators either to the outside of the building, the basement of the turbine station, or into the main mill building.

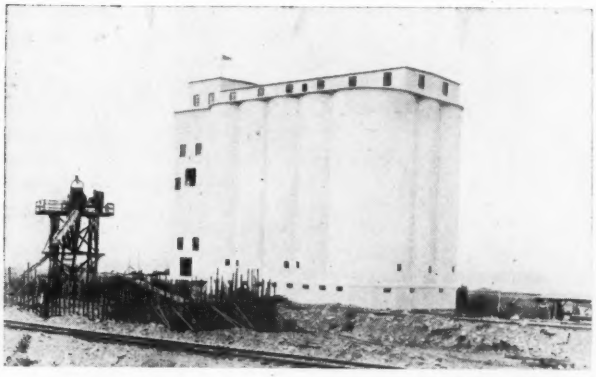
Adjacent to the turbine station is a building about 24x42 ft. in size, in which is located a 300-hp., hand-fired Edge Moor water tube auxiliary boiler served by the main chimney through an underground concrete brick-lined flue. This boiler is used for starting up the plant or operating the turbine station at times when the kilns are shut down. A non-return valve in the steam line from this boiler to the main header automatically cuts out the auxiliary boiler at any time the waste heat boilers are furnishing sufficient steam for the turbines. With both kilns in full operation it has never been found necessary to use the auxiliary boiler.

Coal Mill—Shops—Laboratory

As already stated, the coal mill is a detached building, 50 ft. from the east end of the main mill building. Coal is received in a concrete hopper on a track paralleling the building. A 30-in. belt conveyor fed through an automatic shaking feeder takes the coal to a 24-in. double-roll crusher. After passing over a magnetic pulley to remove tramp iron the coal is elevated in 14-in. buckets to a 60-ton steel bin. This bucket elevator, like those in other parts of the plant, is enclosed in a concrete casing.

A screw conveyor feeder delivers the coal from the 60-ton bin to a 5x50-ft. Ebro coal drier. The dried coal falls into a 14-in. bucket elevator, which discharges 40 ft. above into a 12-in. screw conveyor feeding three steel bins over the three 42-in. Fuller mills. Each mill is driven by a vertically mounted 75-hp. motor. Two mills are sufficient to supply the kilns, the third being for reserve.

A 12-in. screw conveyor delivers the pulverized coal to a third 14-in. bucket elevator, which in turn delivers the coal to a 12-in. screw conveyor running on a



Reinforced concrete stock house and packing plant

Office and laboratory (left), mill (right)

bridge between the coal mill and the main mill building.

The office, laboratory, general warehouse and machine shop are all housed in a building 67x122 ft., 150 ft. west (toward the crushing plant) of the stock house. Tracks running into the east end of this building make it possible to repair locomotives, shovels, or any railway equipment on the floor of the machine shop.

Between the machine shop in the east end of the building and the office and laboratory at the west end, is a store room, set off from the shop by a wood-latticed partition. In addition to the usual machine shop equipment there is a hand-operated traveling crane spanning 18 ft. in the center of the building.

A blacksmith shop is housed by a separate concrete building about 22 ft. in width by 26 ft. in length and 20 ft. in height, which adjoins the shop building at the east end and from which there is an 8-ft. sliding door into the machine shop, as well as a similar door to the yard.

Conclusions

"The proof of the pudding is in the eating." The Petoskey cement plant, designed to produce 2000 bbl. per day, has operated continuously since the day of its completion and turned out in the month of September 68,000 bbl.

In addition to the officers already named, E. C. Switzer is general superintendent, Carl Phillips is chemist and H. Vanderwerp is sales manager.

Another Renwick in the Field

THE announcement that George W. Renwick has been appointed sales manager of the Chicago Gravel Co., with headquarters in Chicago, will be most welcome to his many business associates and well-wishers in the industry. Every gravel man in the Middle West knows his dad, George W. Renwick, head of the company, for he was in the gravel business when "there wasn't no such thing" —in fact he was the first operator to introduce crushers in gravel pit operation.

And Sales Manager George is a chip off the old block. He began his business career in the office of the company, then went to the Joliet, Elgin and Peoria plants, always working his way upward and onward until now he has received this appointment as a reward for his endeavors.

Of course, he served in the World War, like every red-blooded young American, in 1917 and 1918. When it is said that he chose the Marine Corps as his branch of the service, we know that he scratched *some* gravel. It takes "sand" to measure up to the requirements of that husky branch of the army. When he came home it was off with the trappings of war and dig in once more on the business man's problems. He will, says the company, devote all his efforts to serving the interests of the customers. May success attend him!

President of National Lime Association Serves on Secretary Hoover's Committee

CHARLES WARNER, president of the Charles Warner Co., Wilmington, Del., producers of lime, limestone, sand and gravel, and dealers in all building materials, is a member of a permanent National Committee to consider methods of improvement in business practice, the seasonal character of the industry, its finance and other features bearing upon the whole problem of construction. Mr. Warner has just been appointed by Herbert S. Hoover, as chairman of the President's Conference on Unemployment.

Charles Warner

Other prominent men asked by Secretary Hoover to serve on this committee are: Gen. R. C. Marshall, Jr., general manager of the Associated General Contractors, Washington, D. C.; Ernest T. Trigg, president, National Federation of Construction Industries, Philadelphia, Pa.; Alexander M. Linnett, president, U. S. League of Building and Loan Associations, Newark, N. J.; Irving L. Hiett, president, National Real Estate Board, 612 Madison avenue, Toledo, Ohio; Walter Stabler, controller, Metropolitan Life Insurance Co., New York City; John H. Kirby, John H. Kirby Co., Houston, Texas; Dr. J. T. Duryea, president, Pierce, Butler & Pierce Mfg. Corp., 437 E. 162d street, New York City; A. M. Maddock, Thomas Maddock Sons Co., Trenton, N. J.; Richard E. Schmidt, Richard E. Schmidt, Gardner & Martin, Chicago, Ill.; Calvert Townley, Westinghouse Electric Co., Pittsburgh, Pa.; John Donlin, American Federation of Labor, Chicago, Ill.; C. F. Lang, president, Lakewood Engineering Co., Cleveland, Ohio; Daniel Crawford, Jr., 701 Sixty-third street, Philadelphia, Pa.; Geo. Simmons, Simmons Hardware Co., St. Louis, Mo.; W. L. Clause, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Tentative Program of American Good Roads Congress

AS ROCK PRODUCTS for January 14 goes to press the following features of the tentative program of the twelfth annual good-roads congress under the auspices of the American Road Builders' Association at Chicago on January 16 to 20 are announced as of direct interest to its readers:

Bituminous Roads—"Utilization of Local Material for Mineral Aggregate," by Major W. A. Welch, chief engineer Palisades Interstate Park Commission, New York; "Specifications of Mineral Aggregates," by Roy M. Green, manager Western Laboratories, Lincoln, Neb.; "Simple Graphic Method of Proportioning Sands for Sheet Asphalt Mixtures," by Prevost Hubbard, chemical engineer the Asphalt Association, New York.

Concrete Roads—"Selection of Mineral Aggregate for a Portland Cement Concrete Road," by John H. Mullen, chief engineer state highway department of Minnesota; "Design of Concrete Roads for Heavy Traffic," by W. D. Uhler, chief engineer Pennsylvania state highway department; "Inspection and Control of Materials for Concrete Roads," by R. W. Crum, state testing engineer of the Iowa State Highway Commission; "Importance of Surface Finish and Methods of Control," by H. E. Breed, consulting engineer, New York City; "Single-Track Concrete Roads for the Average County," by P. C. McArdle, county highway superintendent, Vermilion county, Danville, Ill.

Common Roads—"Common Roads," by T. J. Wasser, state highway engineer, Trenton, N. J.; "Systematic Study of Gravels for Road Purposes," by Wallace F. Purrington, New Hampshire state highway department.

Highway Research—"Highway Research," by W. K. Hatt, professor of engineering, Purdue University; "Highway Researches and What the Results Indicate," by A. T. Goldbeck, U. S. Bureau of Public Roads; "The Highway Outlook," by Thomas H. MacDonald, chief U. S. Bureau of Public Roads; "Construction and Maintenance of Earth Roads," by George E. Johnson, secretary of public works, Lincoln, Neb.; "Highway Construction on the Pacific Coast," by Herbert Nunn, state highway engineer, Salem, Ore.; "Co-operation of All Parties Interested in the Construction of a Modern Road," by William Ord, the Lakewood Engineering Co., Cleveland; "The Business End of a State Highway Department," by Charles M. Upham, state highway engineer, North Carolina State Highway Commission; "The Highway Contractor's Problems," by H. H. Wilson, Winston Brothers, Muncy, Pa.

Average Cost Per Mile of Roads

OF THE average cost per mile of the different grades of roads built in the United States with Federal aid during the past four years, graded and drained roads have cost $8115; sand clay, $8250; gravel, $10,400; macadam (water-bound), $17,320; macadam (bituminous), $31,300; bituminous concrete, $30,350; concrete, $39,540; brick, $49,570.

Lime and Tuberculosis

Reason to Believe that Breathing Lime and Limestone Dust Is Actually Beneficial to Sufferers from the "White Plague"

By Nathan C. Rockwood
Editor, Rock Products

THERE are some published data on the effect of lime and limestone dust on the general health of workers. There have been two or three more or less scientific investigations of the effect of lime and cement dust on persons suffering from tuberculosis. These data and investigations have not been particularly favorable to lime.

Although these investigations are probably unknown to the great majority of limestone quarrymen and lime manufacturers there is, and apparently has always been, a widespread belief among them that lime and limestone dust was actually beneficial to persons suffering from respiratory diseases. Having learned from reliable sources of two or three specific cases where a cure of tuberculosis was apparently made by working in lime plants, the editor of ROCK PRODUCTS brought the matter to the attention of the National Tuberculosis Association, and as a result W. I. Hamilton, industrial research secretary, has expressed great interest. But he is, naturally, rather skeptical. He wrote: "Our thought on the relationship of tuberculosis and the manufacture of limestone and limestone products has been based largely on Dr. Hoffman's studies as reported in 'Mortality from Respiratory Diseases in Dusty Trades,' U. S. Department of Labor, Bulletin of Labor Statistics No. 231, from which I have extracted the following":

Negative Evidence

The lime and cement industries are so closely related to each other that for practical purposes it has been found difficult to give separate consideration to the mortality returns for each group of these employments, which have therefore been combined to provide a more substantial statistical basis in support of the conclusions advanced. Cement and lime, of course, have different properties, dependent upon their chemical composition and the methods of manufacture, and are generally classified either according to the chemical reaction involved in setting or according to the conditions under which they will harden. Chemically pure lime is the oxide of calcium, which, as shown in the description of the cement industry, constitutes the major portion of the cement product.

Lime is a strong caustic alkali which unites readily with many substances and is readily soluble in water at ordinary temperature. On this account it is claimed that the inhalation of lime dust is non-injurious, and some authorities go so far as to ascribe beneficial results to lime-dust exposure as a precautionary measure against a risk of tuberculosis. There are, of course, numerous varieties of limestone which may vary in their effects and unquestionably do so where there is a considerable degree of intermixture with shell, chalky, cherty, or other substances.

The general processes of manufacture, without reference, however, to sanitary conditions or dust exposure, have been described in a report of the Missouri Bureau of Geology and Mines on Lime and Cement Resources (Jefferson City, Mo., 1907) and in part 2 of the Mineral Resources of the United States for the calendar year 1913, by Burchard and Emley, on "The Sources, Manufacture and Use of Lime." The annual reports of the United States Geological Survey emphasize the magnitude of the lime industry, but no satisfactory statistics are available concerning the health of this class of employes with special reference to tuberculosis, other than the data elsewhere included in the discussion.

Hayhurst in his report on health hazards in Ohio reports upon conditions observed in seven establishments employing, however, only 188 persons. A brief reference is made to dust exposure in the drawing or unloading of the kilns in connection with which no protective devices were employed. As regards grinding and packing, it is said that this is done in all plants, but is practically a side practice or process of lime manufacture. It is explained that the lumps of lime after cooling on the floor space are taken to the mill and ground to powder and then sacked by machinery.

The health hazard is referred to as "very bad." The air is dense on account of the dust in some places, and in only one was there an efficient suction system, in connection with which it is pointed out "the saving of lime collected paid a very good interest on the money invested in the blower system." Skin irritation, especially in summer, is referred to as frequent, and eye inflammations were complained of, but there is no mention of a specific liability to pulmonary tuberculosis. The idea seemed to prevail that the inhalation of lime dust was beneficial and in some communities medical evidence to this effect was quoted. Some of the men observed, however, were decidedly pale and a few were short of breath, an impairment acquired since entering the plant.

The relation of lime-dust inhalation and pulmonary tuberculosis was investigated by Reckzeh, who, according to a brief statement in the Medical Record for December 5, 1903, concluded that—

"The statistics in lime-producing districts show that pulmonary tuberculosis is rare, and that sometimes when present its course is favorably affected. Various authors ascribe this beneficial effect to different features attending the occupation of lime burning. Such are an effect of the inhaled lime dust in facilitating calcification of the suppurating foci, the dryness of the inhaled air, and the deeper respiration it makes necessary, the warmth of the inspired air, which contains no tubercle bacilli, and the more active metabolism it causes. In order to determine the effect of the lime dust suspended in the air the author caused eight tuberculous patients to inhale air charged with the dust by striking suspended bags filled with powdered lime. At first the inhalations were carried on for five minutes daily, but the time and frequency were gradually increased. The results were without encouragement, no improvement in the pulmonary condition was noted, while there were marked undesirable secondary effects, such as headache, loss of appetite, and nausea."

Some Reasons Why Previous Investigations May Have Failed

The above investigation lumped lime-plant and cement-plant workers in the same category. While it is true that cement is made chiefly of lime, there is not supposed to be any "free lime" in portland cement, and, moreover, cement dust contains appreciable amounts of silica. While cement dust probably is not particularly harmful to workers, it is altogether a different kind of a dust than either pure lime or limestone.

Again, many conclusions as to the effect of limestone dust upon workers have been based upon mortality statistics of stone cutters, in which were included workers on granite and sandstone as well as limestone and marble. Now granite dust and sandstone dust are entirely different things from limestone or marble dust. Granite and sandstone are quartz—silica—which is an *acid*, inert and insoluble in water and most other liquids. Limestone is an *alkali*, somewhat soluble in water, and quite soluble in water containing carbon dioxide. This makes a vast difference in the effect of the dust on the lungs.

There is plenty of proof that inhaling silica dust, coal dust, and any other *inert* mineral dust helps cause tuberculosis of the lungs. The confusion has come from class-

Lime in Air Cures Many Cases of Tuberculosis

JUST as the accompanying article went to the printer, Col. C. W. S. Cobb, of St. Louis, sends the following newspaper clipping:

Special Cable to the Times by Arrangement with New York Herald

PARIS, Jan. 4.—A new method of treating tuberculosis, which has resulted in complete cures in 40 per cent of the cases in which it has been tried, has just been reported to the Academy of Medicine by Professor Coutiere.

Having observed the immunity from consumption enjoyed by lime workers, Prof. Coutiere reproduces as nearly as possible the conditions under which they work by means of warm, dry air, saturated with chalk dust, calcic powders and carbonic anhydride. With an easily managed apparatus he makes the patient breathe deeply and continuously in this atmosphere.

The chemical, bacteriological and radiological results are all said to be equally striking in this entirely new method of combating the much dreaded disease.

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ing lime and limestone dust with inert minerals. Lime dust is *not inert* either in or out of the human body.

Possible Theory

Under normal, healthful conditions the human blood is slightly alkaline, just as healthy soil is slightly alkaline or "sweet." When a soil becomes sour or acid, conditions are made favorable for the development of harmful bacteria and most crops are decreased and injured, if not actually annihilated. When the blood of a human being becomes acid it is a sure sign of an unhealthy and diseased state. Disease-breeding bacteria, including tuberculosis bacteria, or bacilli, thrive only in acid surroundings. They are acid-producing bacteria.

In healing a tubercular lesion it is surrounded by calcareous matter. In other words, it is necessary that calcium in some form be present in the blood and tissues. The lungs are full of carbon dioxide gas, as it is the function of the lungs to remove this waste product from the body. The lungs certainly contain water—moisture—and a combination of water and carbon dioxide acts very readily either on lime or limestone, converting it into the soluble bicarbonate of calcium.

It is quite possible that calcium in this form is readily available for bodily needs and is a substantial help in making the blood and lung tissues sufficiently alkaline to overcome conditions favorable to the increase of tuberculosis and other disease-breeding bacteria. Or it may be the calcium gets into the blood from the dust swallowed. That a deficiency of calcium in the rations of milk cows is a contributing cause to tuberculosis in these animals has been definitely proved in several investigations—notably by those of the state agricultural experiment station of Oregon.

The foregoing theory was submitted by the editor to William Brady, M. D., Buffalo, N. Y., whose articles on health are familiar to readers of the leading daily newspapers throughout the country. Dr. Brady wrote: "Your speculation concerning the influence of lime and limestone dust in tuberculosis bears at least this extremely unusual feature in such speculations by laymen: Your ideas all seem reasonable from a scientific point of view. As a rule when a layman enters upon such speculations he soars above any mere restrictions of scientific knowledge.

"It is pertinent that limestone dust does not seem to favor tuberculosis of the lungs as other stone dusts do in industrial hygiene. But workers exposed to lime dust seem to suffer upper respiratory tract troubles frequently. I hope something of value may come from your inquiry. And I shall pass on the suggestion for hydrated lime in bread, when opportunity presents, for I think that may be useful for many readers to know."

What Producers' Experience Has Been

Charles Warner, president of the Charles Warner Co., Wilmington, Del., writes:

"I note yours of the 2d regarding the effect of lime dust on tuberculosis sufferers, and will advise that our observations have mainly indicated that men with weak lungs seemed to have their general physical condition improved by working in a moderate dust condition around lime plants.

"I suggested the possibility of such a treatment to a local physician who has made a pretty broad study of, and is considered a prominent local specialist on, tubercular troubles (he is in charge of a tuberculosis sanitarium near Wilmington). He concluded to make some trial of a treatment of this kind, using some of the very finest forms of hydrated lime injected into a closed room by spraying methods. I have forgotten the exact details, but he concluded that the irritation of the lime dust on the membranes of his patients more than offset any advantage they were gaining—if any.

"I can see how it was possible that patients who had never been in contact with lime dust would feel this irritation actively for a short while. This is exactly the experience of any new worker who is injected into our lime plants. The irritation is quite pronounced and it creates a burning sensation with occasional sneezing and coughing for a week or ten days, until the worker becomes hardened to this local irritation. After that the dust does not seem to disturb him.

"It may be that our local doctor did not feel safe in carrying his patients through the preliminary stage of hardening their throats and nostril membranes to the normal lime action. If this stage were passed by very gradual treatment it is possible that the ultimate effect of a moderate lime-dust atmosphere over a period of several months would begin to react favorably in isolating the disease. My understanding is that the effect of lime action on the lungs is not one of curing the section already diseased, but of stopping the spread by surrounding the diseased section with a calcareous coating."

Col. C. W. S. Cobb, president of the Glencoe Lime and Cement Co., St. Louis, Mo., writes:

"I have gone over the matter very carefully with our superintendents, who in turn have talked with the men about our plants, and I have obtained the following: At our Glencoe plant we have working for us today one H—— H——, 75 years old. He has worked at this plant for 45 years. He tells us that his mother died of tuberculosis at the age of 30 years. All of his uncles on his mother's side also died of this disease, and he himself had a daughter die at the age of 30 years of the same trouble. Mr. H—— says that he is satisfied in his own mind that his long life can be attributed to the years he has worked at the lime plant. His years of service have been wholly confined to firing the kilns and working on the floor of the plant where he has constantly been inhaling lime dust.

"At our Mincke plant the superintendent reports that he had a man (name unknown) who worked for him for 23 years. He was a strong, husky fellow and worked on the lime floor all the time. His wife died of a lingering case of tuberculosis, and three years after his wife's death he was taken with the disease and died after 15 months' illness. This superintendent tells me, after 40 years' experience in lime plants, that the men he had been constantly with all these years have been noticeably free from illness of any kind, and the above mentioned instance is the only extreme case of tuberculosis he can remember. His experience has been wide and he has handled a large number of men. It has been very plain to him that the men who work in lime plants are unusually healthy—as he expressed it, they have always been ready for meal time.

"As far as my personal knowledge goes, it has been very clear to me that men who follow the lime business—that is, working in and around lime plants, in lime and limestone duse—have been free from all diseases."

William E. Carson, president of the Riverton Lime Co., Riverton, Va., writes:

"I know, actually, of only one case of tuberculosis that I believe was cured at our plant. This case was in the incipient stage. But I do know that we have never had a case among any of our men while they were working with us.

"I wish I had some more definite information to give you, but I am very much of the opinion that an early case of tuberculosis can be greatly helped, if not cured, by getting in a 'limey' atmosphere.

"Along this line, I want to tell you an interesting thing. Years ago when we used to have a large slaked lime pile, diphtheria cases used to be sent to this lime pile, when it was stirred up, on the belief that continual coughing, sneezing, etc., helped; possibly this 'cure' killed more than it saved; anyhow in my youth I remember it was quite common for children to be sent to play around the slaked lime pile for their health."

Bernard L. McNulty, general manager, Lehigh Lime Co., Chicago, Ill., writes:

"When I was in Anniston, Ala., operating the La Garde Lime and Stone Co. plant, we had a man as chief engineer by the name of P——. This man had a son who had been working in the steel plants at Birmingham. The son's physical condition was such that the doctor said he was subject to an

attack of tuberculosis. He was advised to give up his employment.

"This boy came to La Garde. His father erected a canvas shelter so that he could rest and sleep in the open air. I recommended to the father, when I saw this, that the young man go to the lime plant, as I had heard that inhaling lime dust was beneficial in tuberculosis cases.

"It was with great difficulty that the young man was able to walk to the hydrating plant, on account of his weakened condition. This was the dustiest place in the plant and he spent some little time around there inhaling the lime dust. Within a few weeks he commenced to show signs of improvement, and it was not long before he was able to perform some work, so we put him to work in the hydrating plant. His strength rapidly recovered and in a short time he was able to work out in the quarry, breaking rock, which you know is an arduous task.

"This occurred in 1913, and within a few months after his appearance at La Garde, he left in apparent good health."

George Nicholson, Jr., secretary of the White Marble Lime Co., Manistique, Mich., writes:

"To be specific it is rather hard to definitely state that they were helped, but we had in one instance particularly, an Austrian by the name of F—— R——, who was afflicted with tuberculosis, and on account of his earning power we put him on a bagging machine. He stuck to it for better than a year, then went to a sanitarium for a period, I believe, of three or four months. He has married since and has two or three children. While no longer in our employ I have kept watch of him and he seems vigorous and entirely free from the affliction."

G. H. Angus, director, Theo. H. Davies & Co., Ltd., Honolulu, H. I., writes:

"Upon referring this matter to H. R. Hicks, superintendent of the Waianae Lime Co., he informs us that the fact that lime and limestone dust are beneficial to tuberculosis sufferers is nothing new to him. He has not had any experience with anyone afflicted with this disease here in the Islands, but he states that while he was connected with the Holmes Lime Co. at Felton, Calif., there were two or three men suffering from tuberculosis employed in that plant, and that they were materially benefited by the lime and limestone dust. He does not recall the names of these men, nor is he able to say they were entirely cured. However, he is very emphatic in stating that they were geatly relieved. Mr. Hicks also knew of a very bad case of asthma that was benefited greatly by coming in contact with lime and limestone dust. He says the man afflicted with this trouble started to work for the Holmes Lime Co. and within three weeks he was entirely cured. This speaks very well for lime as a means of relief from asthma."

F. C. Cheney, general manager, Cheney Lime Co., Allgood, Ala., writes:

"It is our belief that a person suffering from tuberculosis of the lungs is benefited by working in lime dust. We know by our own observation here that lime workers do not suffer from catarrh. If they have been suffering from catarrh and come to work here for a short time they gain in weight."

H. E. Rodes, secretary and treasurer, Franklin Limestone Co., Nashville, Tenn., writes:

"A little more than eight years ago a man by the name of F—— L——, came to our Franklin plant to work. At that time he had all the symptoms of tuberculosis. He was placed feeding stone into a gyratory crusher. He has been at that work ever since and is today strong and well."

John S. McMillin, president of the Tacoma and Roche Harbor Lime Co., Seattle, Wash., writes:

"I have been engaged in manufacturing lime for nearly 40 years and during that period there have been three or four distinct cases where my employes working in the kiln department of our plant have been greatly benefited and have grown strong under the conditions surrounding that labor. I cannot say that any of these men were definitely afflicted with tuberculosis, but there have been two or three marked cases of weak, sickly-looking individuals who have worked in that department, and who soon became strong and vigorous.

"I recall two instances in particular which developed under the old system of spreading the lime out on the floor for cooling, then shoveling it into barrels. The drawing of the lime and the shoveling it into barrels made it unavoidable for these men to breathe more or less of the fresh lime dust. I remember that one of them had great trouble from bleeding at the nose and other evidence of weakness when he first came to work in the lime dust, but he stuck to it, and after a few weeks began to improve, and was soon a very sturdy, active and vigorous fellow. He not only breathed a good deal of lime dust but he constantly drank the hard lime water that comes out from under our ledge in a beautifully clear stream.

"Of course, the exercise may have contributed, and probably did contribute, to his physical upbuilding. How much of his cure could be accredited to the lime dust and how much to good healthful exercise and drinking lime water, I cannot say, but I know that he always thought that breathing the lime dust was what had made him the strong man he was. This was 25 years or so ago and I do not know what became of the man.

"Personally I have no doubt that working around a lime plant, or lime kilns, is one of the healthiest occupations in which any man can engage, and while I am not able to submit any statistics or record of value, I am convinced that lime gotten into the system in almost any way is beneficial. We know that it is one of the greatest deodorizers, disinfectants and purifiers that the world has ever discovered."

Gordon Willis, president of the Hunkins-Willis Lime and Cement Co., St. Louis, Mo., writes:

"We referred your inquiry to our Mr. Marr, superintendent of our subsidiary, the Peerless White Lime Co., St. Genevieve, Mo., from whose report we quote: 'I have never had any experience with anyone working in the lime business who was suffering from tuberculosis, but I do know that working in the lime shed is very healthful, although it may be disagreeable. During the "flu" epidemic of two years or so ago about 75 per cent of our quarry force was incapacitated, *but none of the men working in the lime shed were affected.*

"'It is opportune to call your attention to the following: I have had many years' experience in quarry work and have known a number of stone cutters who contracted tuberculosis by working on sandstone, which contains grit and sulphur. These stone cutters have completely recovered by working only in localities where limestone was used for cut stone.

"'I also know that the average life of a stone cutter working in sections in the North of England was about 30 years, but I have seen men 84 years old cutting limestone in the South of England. In fact this is one of the principal reasons why so small a percentage of sandstone is now used for building. Stone cutters and machine men would not willingly work on sandstone.'"

John Sloan, of Waukesha Lime and Stone Co., Waukesha, Wis. (secretary of the Wisconsin Granite Co., Chicago), writes:

"I have found four lime burners whose ages run from 62 to 90 years—who have worked at burning lime off and on from 30 to 40 years. They were of course constantly in an atmosphere of limestone dust, as well as lime dust. There are no more rugged specimens of humanity, and they claim to have always been in the best of health. Two of these men, one 90 and the other 85, are living near Waukesha now."

C. C. Kenny, secretary of the Le Gore Combination Lime Co., Le Gore, Md., writes:

"The following is the detailed history of a case that occurred at our plant: L—— McC—— W——, white, age 28, married, in 1911 had pneumonia and was bedfast for 9 months and 11 days. This left him with one weak lung, which his physician said would always cause trouble. It was diagnosed as tuberculosis, and he was advised that he had but a little while to live, unless some cure could be effected.

"He went to work on a farm the following year and remained there for about one year; then went to work for the Ox Fibre Brush Co., Frederick, Md., where he remained about three years. During this time

his ill health grew steadily worse, and he was compelled to leave Frederick and give up his work there. He moved to Jefferson, Md., and was practically without employment for a year. He was now unable to do more than a few hours work a day, and that had to be very light, easy work.

"He moved from Jefferson to Le Gore and was employed by this company to work in the lime mill. He was unable to work more than half a day at a time and then do only light work. However, he began to gain in strength almost immediately and after about three months was able to work full time and do regular employment. He remained in the mill about two years, and at the end of that time he felt in first rate condition and had no indication whatever of lung trouble. Since then he has been engaged in very trying work without any return of his former trouble.

"This information was given us by the man himself. We can verify it so far as it pertains to our plant. The physicians whose names we have given can verify their connection with his case. We might explain that this man's work here required him to be constantly in lime dust. He was employed to help feed the mill, and there was hardly a period in any day that he would not breathe his portion of lime dust. Mr. W—— asserts that he does not believe he would have lived through the year following his experience at Jefferson, had he not come to our lime plant. We are of the opinion that the lime dust did work a remarkable cure in this case.

"There have been other cases somewhat similar but the principals are not now with us and it is extremely difficult to get information that would be consistent."

Ben L. Schultz, president of the Crystalline Lime Co., Lewiston, Idaho, writes:

"We have never noticed any particular results in connection with tuberculosis. We have, however, noticed that lime and limestone dust has a decided effect on a person suffering from catarrh. This was first noted by me personally, and it came about in such a way that I made mention of it about two weeks ago to one of our firm members.

"I would stand around the crusher inhaling the dust from the limestone. I could see that my breathing would be improved wonderfully, and I feel quite sure that this will result in curing my case of catarrh. While I am only at the crusher a few minutes, I notice the difference at once."

A. C. Root, president of the Kaweah Lime Products Co., Fresno, Calif., writes:

"We have a perfect demonstration of the value of limestone dust in the case of the wife of our mechanical superintendent. They came here four years ago from Michigan and the wife was in a very bad condition. Both lungs were affected, but she has practically recovered. In discussing the matter with her, she does not give the credit entirely to breathing the fine limestone dust, but gives greater credit to living in a tent in the open. Of course, I believe that the limestone dust has been of benefit to her, and her husband does also."

W. T. Kuehn, president of the Elliston Lime Co., Helena, Mont., writes:

"During our operations for the past 19 years we have had all kinds of labor—men of all characters and creeds, men who had miners' consumption and men who were frail, but could do a good day's work for us where their strength failed in other jobs. During those 19 years but one man in our employ has ever been lost by death, and that was a case of too much drink. During the 'flu' epidemic a few of our men had the disease but got over it without the aid of doctors. For years I have had in mind that working in lime plants was healthful work."

H. A. Gawthrop, manager of the Merion Lime and Stone Co., Norristown, Penn., writes:

"I cannot help at this time but comment on the fact that when the 'flu' was so prevalent a few years ago, and so many deaths occurred, the men in our hydrated lime plant were the only men around our plant who worked continuously through the epidemic period without loss of time on account of sickness. We have never known lime dust to be harmful to any of our men; in fact, a man who has been working in it for some eight years told me, only the other day, that he was never better in his life than since he has been working for us. I, myself, during the 'flu' epidemic purposely spent considerable time in the lime plant to ward off the disease."

Bert Herzog, of John Herzog and Son, Forest, Ohio, writes:

"Our experience has given us the impression that lime is very good for catarrh; and we have observed one man who has now worked about the lime plant for 10 years; when he started he looked very much as though he had tuberculosis; he appears to have gotten stronger."

M. L. Graybeal, of the Blue Grass Lime Co., Maxwell, Va., writes:

"We have a man working for us by the name of W. E. L——, who has been with us for more than three years. This man had had lung trouble for many years. Within the last 18 months this fellow has gained 20 lb., looks good in the face, is strong, works every day and says his lungs do not now give him any trouble."

G. J. Whelan, general manager of the Kelley Island Lime and Transport Co., Cleveland, Ohio, writes:

"We do not recall any particular instance where a person suspected of being afflicted with tuberculosis has been cured or attempted to be cured in any of our plants. However, we can say that the writer was superintendent of the Marblehead plant for a period of 15 years, and during that entire time does not recall that any employe working in the lime plants died from tuberculosis. In fact it always appeared to be a very healthful occupation.

"The writer recalls different people having remarked that in their opinion they believed persons in the first stages of tuberculosis could be cured if they were to take up work in lime-kiln plants. The fact that during the 15 years referred to there was never a case of lung trouble developed would indicate that there must be some merit to the information contained in your letter."

R. G. Spencer, general manager of the National Lime and Stone Co., Carey, Ohio, writes:

"We do know of a case that will bear out your contention and will try to get in communication with an old lime manufacturer in order to obtain, if possible, specific dates and other data."

John J. Porter, first vice-president and general manager of the Security Cement and Lime Co., Hagerstown, Md., writes:

"I have submitted this matter to E. F. Alderton, superintendent of our Berkeley plant, who has been at this plant for many years. He advises me that he has never known of a man afflicted with tuberculosis being employed here, and is therefore unable to furnish any specific data. Of course, it is well recognized, at this plant, as at others, that lime dust has a beneficial effect on pulmonary troubles, and I have frequently heard it remarked that a 'skinny' man working under these conditions would soon begin to take on flesh."

F. C. Beatteay, of Stetson, Cutler and Co., St. John, N. B., writes:

"I am strongly of the opinion that lime and limestone dust is actually beneficial to tuberculosis sufferers. I have in mind one case, a man named C—— K——, who has been employed by us a number of years. K—— worked for us as a cooper, but was compelled to leave the cooperage shop on account of severe bleeding attacks. He was pretty badly run down. Four years ago he went to work in the lime plant, and I am pleased to say that since that time he has been greatly improved in health and has had only one attack of bleeding."

A. J. Blair, treasurer and general manager, Lake Shore Stone Co., Milwaukee, Wis., writes:

"Our experience, sorry to say, does not bear out your theories. We have had two of our former employes—brothers—die from tuberculosis. One of them fed the crusher at Lannon for a considerable number of years; the other not any great length of time. I do not believe that their working at the crusher had anything to do with their contracting tuberculosis; but, nevertheless, I could hardly say that this form of employment was beneficial to them. We think there must have been a predisposition to tuberculosis in their family, possibly coupled with too much booze. They were both what could be termed fairly hard drinkers. This has been our only experience and possibly has not been duplicated elsewhere."

A. C. Freeborn, general manager, Vermarco Lime Co., West Rutland, Vt., writes:

"I am not able to locate any definite cases that can be shown beyond a doubt to have benefited from working in an atmosphere impregnated with lime. We have only been operating for about four or five years, and would naturally not be in a position to furnish any substantial proof of such a cure.

"Our men have this to say, and I notice their statements to be true, that they suffer very little from colds; and when other members of their families are sick with colds and grippe, our workmen suffer very little from such ailments. These men say it is because they work in the lime-dust atmosphere.

"I have been in the manufacturing end of the marble business for nearly thirty years, and have had during that time a large number of stone cutters under my supervision. In all that time we have never had a case of death from tuberculosis, with the exception of one man who came to us from another town where he had been working on granite and sandstone. He had previously had tuberculosis.

"Our workmen are particularly free from any lung infections. I do not know that this proves that working in limestone dust is beneficial, but it certainly does not prove that it is injurious.

"We have furnished for the past four or five years very fine limestone dust to the Trudeau Foundation at Saranac Lake, N. Y. I have no official report of its experiments and believe it is not ready to publish the results of these tests. The experiments with limestone dust are to determine whether or not it is injurious to workmen. I understand, unofficially, that so far the results point to the fact that this material is beneficial and not injurious to those working in it."

Edward R. Baldwin, director of the Edward L. Trudeau Foundation, Saranac Lake, N. Y., writes:

"The experimental work here is purely with animals. The marble work has not been reported on as yet, but the effect of marble dust is very much less important than that of granite. This, of course, we should expect inasmuch as silica is the principal ingredient of granite dust."

R. E. Vernier, secretary of the Hoosier Lime Co., Salem, Ind., writes:

"We do not recall any specific cases where one suffering from tuberculosis has been benefited from working in our lime plant. We have been informed, however, that prior to our acquiring the property we are now operating, there were several persons afflicted with the disease employed here who were cured; but the information we have is not specific. There is no question in our minds but that lime dust is really beneficial to one suffering from pulmonary tuberculosis, and that it sometimes results in a cure, if the disease is caught in the incipient stage."

George B. Wood, president of the Rockland and Rockport Lime Corporation, Rockland, Me., writes:

"It is spoken of as a fact in this locality where lime has been burned for considerably over a hundred years, that tuberculosis is very rare among the workers at the lime plants.

"The granite industry at one time was also very thriving in this locality, and tuberculosis was most prevalent among the granite cutters. It has always been a matter of note to contrast this with the almost absolute freedom from tuberculosis among lime workers.

"I have noticed in the comparatively short time that I have been associated with the business, that good health generally prevails, and certainly in a great many instances these lime workers live to a ripe old age."

B. F. Pay, of Fowler and Pay, Mankato, Minn., writes:

"We do not recall of ever having in our employ anyone affected with tuberculosis or weak lungs. We can state honestly and truthfully that of the number of men employed around our lime plant we do not know of a single case where any of them have suffered from the effects of the dust. On the other hand, those who were delicate when they started to work for us daily picked up in their general appearance. So it would seem that the lime dust was more beneficial than detrimental. We have heard it said that lime dust is beneficial for weak lungs and tuberculosis patients."

E. J. Heinerdinger, assistant to the president of the Louisville Cement Co., Louisville, Ky., writes:

"It is the writer's understanding that we have at our lime plant at Milltown, Ind., several persons who on entering our employ were sufferers from tuberculosis. After a period with us in the lime business they were apparently cured. I have taken the matter up with our superintendent, who can give us detailed information."

John P. Rich, proprietor of the Swanton Lime Works, Swanton, Vt., writes:

"I believe that you are absolutely right in your assumptions in regard to the beneficial effects of lime burning, but I much regret that I am unable to quote you chapter and verse in proof. Years ago I had in my employ a workman (whose name I have now forgotten) who came to me in rather an advanced stage of consumption. His life was, by his own testimony, prolonged many years by his work as a kiln fireman."

H. J. Russell, president of the F. W. Wait Lime Co., Glens Falls, N. Y., writes:

"Several years ago we had a man working for us outside the lime plant who was found to have tuberculosis. We immediately transferred him to the lime plant where he came in contact with lime dust. We do not know whether lime dust is a preventive or a cure, but this fellow worked in that position for a long time before he was obliged to leave. I don't know as I ever heard of anyone else being tubercular who worked around a lime plant."

J. D. Cowan, manager of the Pierce City Lime Co., Pierce City, Mo., writes:

"We have a man working for us now by the name of A—— L——, who was afflicted with tuberculosis. He was advised to work at the lime plant. He is now stout and one of the best workmen we have. He is sound so far as anyone knows, and he says lime dust cured him.

"While you are on this point let me add that lime is also very beneficial for catarrh. The writer has noticed this very particularly and has wondered if druggists could not be induced to handle powdered lime put up in small quantities."

F. Guenther, general superintendent of the Clinchfield Portland Cement Corporation, Kingsport, Tenn., writes:

"I have made considerable quantities of lime and I do not know that I ever had any person with tuberculosis under me. On the other hand, I do not know of anyone who was ever injured from the effects of lime; in fact, the men seem to be quite healthy."

A. A. Hurst, Maquoketa, Iowa, writes:

"I do not know of a cure being made among our men who may have had tuberculosis, but I do know of a case where a young man who had all the outward appearances of having the T. B. went to work in our lime houses, and after several days claimed he liked the work and felt much better. This young man was called in the draft and was one of the 1918 'flu' victims. I have never heard of a man who had tuberculosis dying while in our employ, and I have been here 27 years."

D. C. Culbert, manager, Culbert Limestone Plants, Marion, Va., writes:

"I thought it was a known fact that limestone and lime dust were beneficial to tuberculosis sufferers. I got this information several years ago, but do not recall from what source. We inform every new employee in our milling and loading rooms that he need not fear the dust, that it is really beneficial. We now have in our employ two men who have been working daily in an atmosphere charged with limestone dust, for 12 years. Each of these men has had only one spell of sickness in that time—one typhoid and the other appendicitis. Both are in excellent health today."

J. F. Pollock, secretary of the Ash Grove Lime and Portland Cement Co., Kansas City, Mo., writes:

"Our superintendent reports that he has had men in our lime-burning department for 25 years, and that he has one man who has worked constantly in the dust of the hydrated lime mill since 1905. Perhaps the fact that these men have worked for such a long time where there is more or less lime dust inhaled may be assigned as a reason why lime dust has a beneficial effect on the health."

The Jesse Allen Lime Co., Burns, Tenn., write:

"We call to mind one man in particular who was given employment at our plant some years ago, and who had tuberculosis in a light form. His work for 20 years was altogether in lime, and today he is living, strong and healthy. We think it is the result of the lime dust. We have never in our experience in the business known of a person working in lime constantly to suffer from tuberculosis, and we heartily recommend lime to these people."

W. H. George, secretary of the Henry Cowell Lime and Cement Co., San Francisco, Calif., writes:

"I remember as a youngster when we used to slake lime in the warehouse to put aboard ocean-going vessels that I used to stand over the slaked lime and cure many a bad cold.

"I have many times heard that in the old countries—France and Germany—tubercular patients were put to work in plants where there was lime dust and were thus cured.

"When our cement-dust nuisance suit was being tried several years ago we had several eminent specialists examine our men and the examinations and testimony disclosed the fact that the throats and noses of the men employed in the cement plant were in great deal better condition than the men employed in other walks of life."

R. F. Marker, general manager of the Pacific Lime Co., Ltd., Vancouver, B. C., writes:

"During the influenza epidemic the disease was prevalent in towns a few miles distant from our plant and attacked almost every isolated point on the coast of British Columbia, but not a single case developed at our lime works. The following year, however, there was a milder recurrence and we had a considerable number of cases."

Conclusions

The foregoing are taken direct from letters as they come in a stack on the editor's desk. No attempt has been made to select the more favorable ones, or keep out the unfavorable ones. They represent the sum total of a canvass of about the whole American lime industry, with some from representative limestone quarrymen who are not lime producers.

The reader is as well able to judge their importance as the editor. We believe they contain enough data to warrant a thorough scientific investigation of the whole subject. Nearly every operator responding, whether he was able to contribute any experience or not, expressed great willingness to aid and promote such a scientific investigation in every way.

The original letters have all been transmitted to the National Tuberculosis Association, and every limestone quarry man and lime plant operator who is convinced in his own mind, either from his own experience or from what is printed here, should use his every endeavor to see this project carried through to its conclusion. Herewith is a list of the members of the advisory committee on industrial research investigation of the National Tuberculosis Association. Hitherto their work has had more to do with occupations which are productive of tuberculosis. Let every man in the limestone industry use his influence to have a little thought and effort directed to an industry which, there is at least some foundation for believing, is helpful to tuberculosis sufferers.

NATIONAL TUBERCULOSIS ASSOCIATION ADVISORY COMMITTEE ON INDUSTRIAL RESEARCH INVESTIGATION

Dr. E. R. Baldwin, Director, Trudeau Foundation, Saranac Lake, N. Y.

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Mr. Frederick M. Stein, a Director, National Tuberculosis Association 50 East 41st street, New York City.

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Action of Retarders on Gypsum

FROM experiments made by the Bureau of Standards, pure calcined gypsum when mixed with water will set in 5 or 10 min. This is too rapid for most work; it does not give time to mold the material into the desired form. A retarder is therefore added, which delays the setting from ½ to 6 hr., depending upon the purpose for which the material is to be used. "Commercial retarder" is a slaughterhouse byproduct of indefinite composition. From the standpoint of the user, this retarder may be criticized on several grounds: Since it is of an indefinite composition, its action can hardly be expected to be uniform at all times; it is rather expensive, and a cheaper material might be found; it slows down the rate of set, instead of delaying the beginning, and in some cases the latter effect is desirable; it seems to prevent the hydration of some of the calcined gypsum, thereby causing a slight reduction in strength.

To answer these criticisms an effort has been made to discover a new material which may be used as a retarder. To date this effort has not been successful, although all of the criticisms have been met except the one of cost.

Irish Gypsum Development

AT KINGSCOURT, some 50 miles from Dublin, Ireland, the Farney Development Co. has recently put into operation its new plaster works. This company has acquired possession of nearly 1500 acres of gypsum land and mineral rights over 2000 additional acres. It will develop gypsum production for the manufacture of plaster of paris and the quarrying of alabaster.

Prof. Henry J. Seymour, professor of geology in the National University of Ireland, states that the minerals consist of gypsum and brick-clay of excellent quality with some sand and gravel. The most important mineral is the gypsum, which appears to underlie the whole of the property. Its presence has been ascertained not only by pits and borings but by quarrying, and in the excavations for the railway. Beds of gypsum varying in thickness from 3½ to 70 ft. have been met with in the eight borings made. A conservative estimate indicates that there are at least a million tons. The upper beds of gypsum, extending over some 15 acres, are sufficiently near the surface to admit of economic working by open quarrying, some portions, indeed, outcropping along the railway line. The greater portion consists of compact crystalline gypsum practically free from coloring matter, and should burn to a white product. The less pure beds should be readily saleable for agricultural uses.

The trade in English alabaster was very ancient, much of the output going to the Continent, where it was worked in the form of richly carved and polished reredoses, tryptches, and other monumental works often enriched with gold and color. The Kilkenny Marble Works, Ltd., will take the entire alabaster output of the Farney Works for the next five years. Some of the blocks of alabaster quarried are of considerable size, and already enough gypsum to last several months has been quarried and lies on the surface ready for use, as well as many splendid blocks of alabaster of large size.

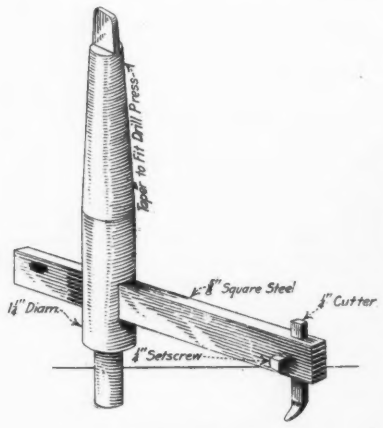
The works are favorably placed. Kingscourt is only 50 miles from Dublin, and the works are within a couple of miles of the railway. The works and the adjoining quarry are on both sides of the railway line. The railway company is about running a siding into the works and has granted very favorable freight rates to the promoters.

Hints and Helps for Superintendents

Valves on Pumps

ONE of the main wearing parts of a pump is the valve. In handling clear water the valves are expected to last, but with grit in the water, the valves and valve seats will not last long, according to Charles Lobbe, in the *Engineering and Mining Journal*. They must be replaced and the seat refaced. Under normal conditions the iron valve seat and the hard-rubber valve are the most economical and give the best service.

Red fibre also gives good service, particularly where odd sizes are used. Fibre valves can be cut on the drill press as well as on the lathe. They are traced on the sheet, the stud holes drilled first, and the outside cut to size with the tool shown in the illustration. The valve seats are faced on the lathe. Often grooves worn in the seats are rebuilt with the oxyweld, and then either dressed on the smooth side of the emery wheel or turned down. In out-of-the-way places, where supplies do not always come when expected, flat valves made of pieces of boiler plate have given surprisingly good service. They were made of the same thickness as the original rubber valves. When slightly worn, they were turned over and later refaced on the lathe. No springs were used in connection with them, and they did not wear any harder on the studs than either the hard rubber or the fibre.



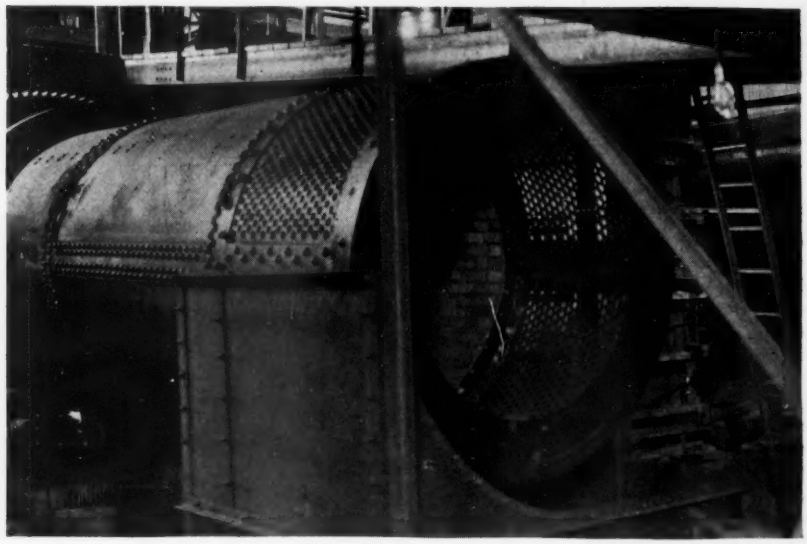
Tool for cutting fiber valves

Valve seats are removed by unscrewing them from the pump, or, if driven, by pulling them out with the wheel puller. Studs wear mostly on one side and must be replaced when in bad order. New studs must not have over ¼-in. clearance between the end and the plate cover, so that if the stud works loose it cannot fail. The yoke holding the valve cover must be of cast iron, and must not be replaced by a solid bar of iron or steel. It works as a safety in case the pump is started against a closed valve in the discharge line and its breaking releases the valve cover. The cost is moderate, and if anything else should break, serious damage would result. To prevent breakage, a relief valve is installed on the bypass line, but to be reliable it must always be kept in good condition and tried out often.

Clinker Screen on Cooler

THE accompanying view shows a scheme for preliminary clinker crushing and screening used at the new plant of the Petoskey Portland Cement Co., Petoskey, Mich.

Attached to the lower end of each cooler is a perforated screen having 1½-in. round holes, so that all the clinker discharged from the coolers must be smaller than 1½ in. An angle iron flange at the lower end of this screen keeps larger pieces of clinker from rolling out of the end of the screen and a cast-iron ball about 8 in. in diameter rolling around in the screen against this angle iron flange serves to break up what few large pieces of clinker are discharged from the kilns. Due to the fine grinding of raw material in the compeb mills and the uniform composition of the feed to the kilns by reason of the wet process, very uniform and small clinker is discharged by the kilns; in fact, the bulk of the clinker is smaller than ½ in. in size.



Clinker screen on cooler

Loading Drilled Holes Without Tamping

THE METHOD used for loading drilled holes in the quarry of the Kelly Island Lime and Transport Co., Gibsonburg, Ohio, avoids the necessity of tamping by making the powder tamp itself. Holes are drilled with a 5-in. bit and 4x16-in. dynamite is used. In loading, the cartridge wrapper is split on one side with a knife and the cartridge dropped to the bottom. The impact causes the dynamite to fill the hole completely.

In the opinion of the superintendent, a further advantage in using the smaller cartridge is found in the ease with which the hole may be loaded. Irregular or crooked holes, that would cause cartridges of greater diameter to bind, may be readily loaded with the smaller cartridges; the expanding of the split cartridge when dropped into the hole gives as good results as much tamping.

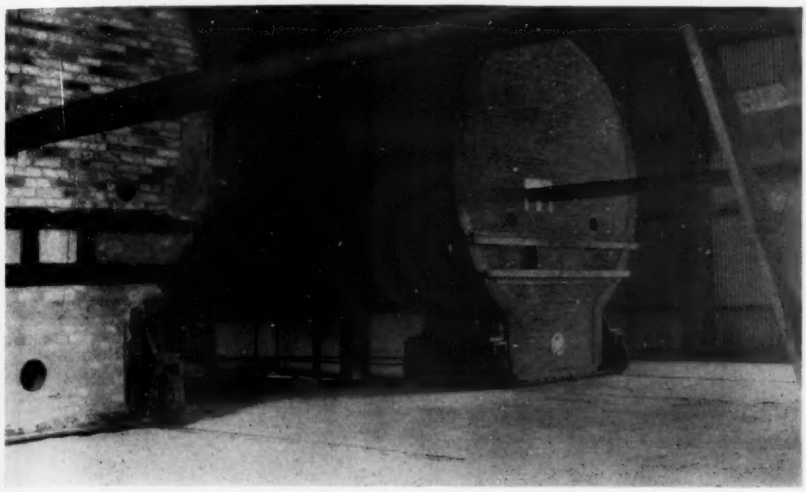
Two primers are lowered as is customary. The impact of following cartridges, however, has the same effect as tamping.

Off-Center Kiln Burners

IN A rotating kiln the material climbs up the side in direction of rotation and slides or falls back to the lowest line of the kiln. In a kiln turning clockwise the bulk of the clinker is therefore in the left-hand semi-circular segment of the kiln, and a large part is always in the lower

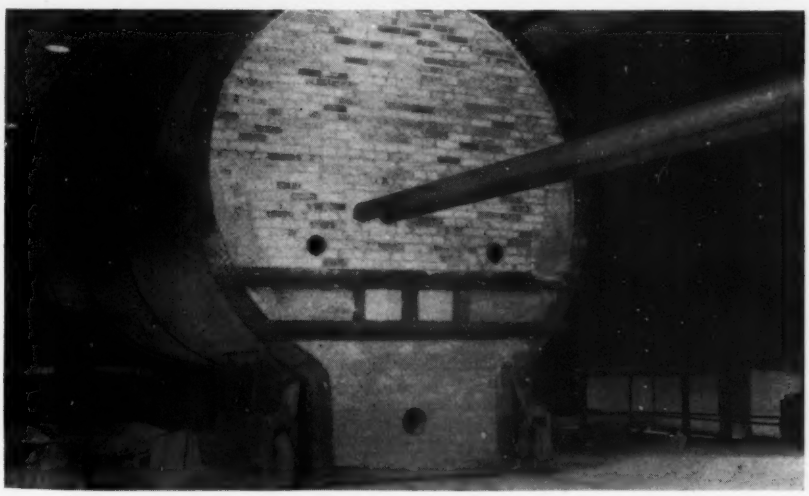
left-hand quadrant. Therefore, when the burner or burners are placed on the center line, or axis, of the kiln the flame is above most of the clinker and is expended on the lining in the upper right-hand segment of the kiln.

To overcome this objection and get the maximum benefit from the burner, J. B. John, vice-president and general manager of the Newago and Petoskey Portland Cement Companies, places his burners in the lower left-hand quadrant of the kiln hood, as the views herewith show. These



Two kilns, 10x150 ft., Petoskey Portland Cement Co. plant

are views of the kilns at the new plant of the Petoskey Portland Cement Co., described elsewhere in this issue. Mr. John



Kiln burner placed in lower left-hand quadrant of hood

claims that this method not only saves the lining but adds appreciably to the efficiency of the kilns.

Air Lift Pumps

WHERE compressed air is available, air lifts are the cheapest and most durable pumps, according to Charles Lobbe in the *Engineering and Mining Journal*, but they may not be the most economical when crudely made. In most cases they are made only when needed and of fittings on hand. Fig. 2 shows a type which can be made in a short time with a 2-in. T, one reducing bushing, one length of 2-in. pipe, one ½-in. valve, one length of ½-in. pipe, a foot or so shorter than the 2-in. pipe, with about a dozen ⅛-in. holes drilled near the end. The one drawback is the depth of submergence that air lifts must have. The foot-piece in rough-and-ready mill work is not important. Small holes drilled around the bottom of the air pipe being the best. For a large and steady amount of water, specially designed and ready-made foot-pieces are used, and usually the pumping costs are less than with any other kind of pump.

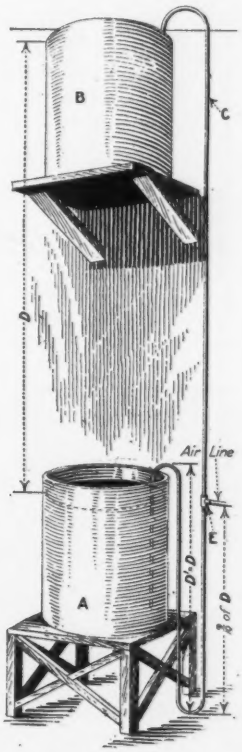


Fig. 1—Method of elevating water

Solution in tank *A* (Fig. 1) is to be lifted to tank *B*, without cutting any holes in the tanks. The pipe *C* will be connected so as to form a siphon over the rim of tank *A* (priming valve on top of siphon) and extended down to a distance equal to *D*. The air pressure will be connected through a *T* at *E*, a point nine-tenths of the distance *D* on the up pipe.

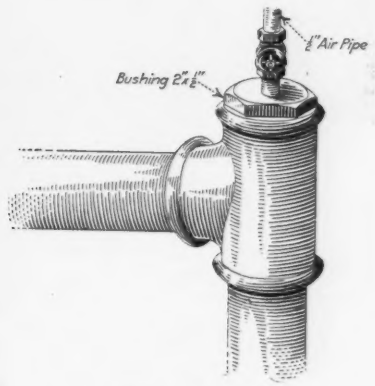


Fig. 2—Air-lift

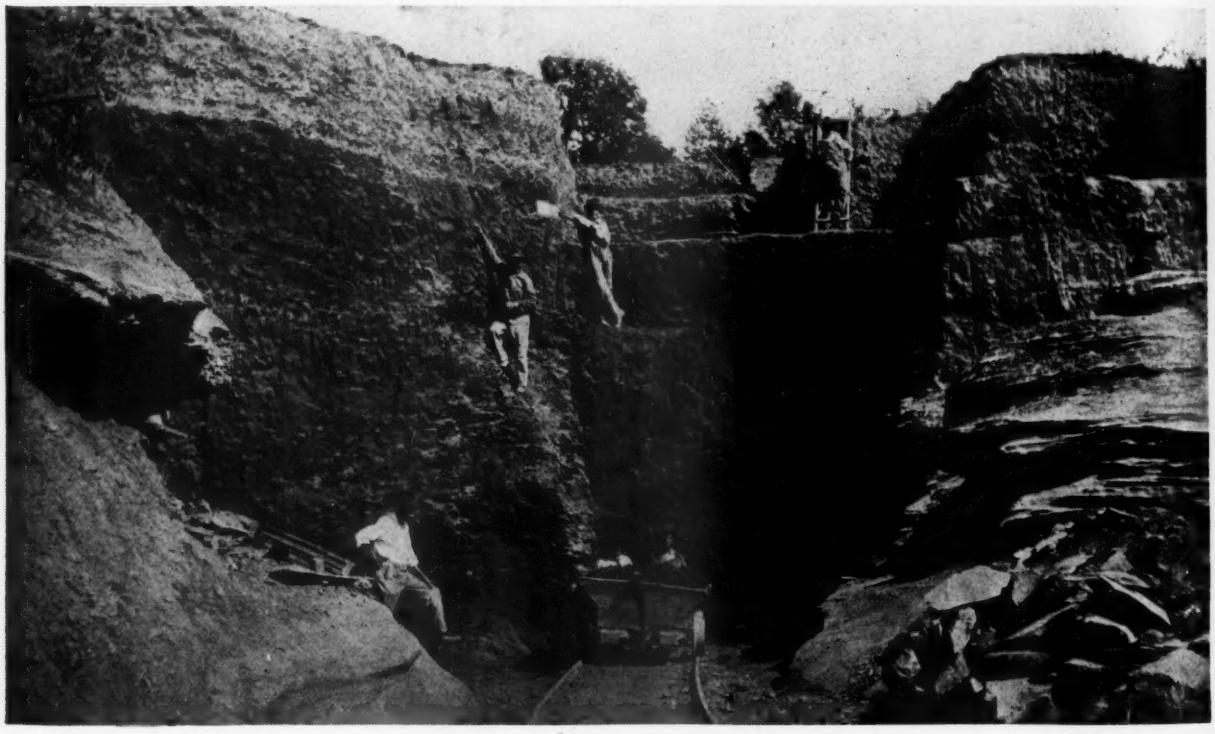
Latest Development in Rock Phosphate Grinding Plants

Plant of Tennessee-Illinois Phosphate Company Presents New Principle in Preparation of Ground Phosphate Rock—Geology of an Unusual Deposit—Details of Simple and Efficient Operation

THE value of ground rock phosphate in direct application to soil as a means of restoring phosphorus content where natural conditions are either present or may be developed has been established beyond a doubt. It has often been stated that the ultimate supremacy of nations may depend on their relative fuel supply, but even more important is soil fertility—the ability to bring into the world, rear and support a superior race. Dr. Hopkins well says:

"Moralists sometimes tell us that the fall of the Babylonian Empire, the Egyptian Empire, the Grecian Empire, the Roman Empire, were all due to the development of pride and immorality among those peoples; whereas, we believe that civilization tends rather toward peace, security and higher citizenship. Is not the chief explanation for the ultimate and successive fall of those great empires to be found in the exhausted or wasted agricultural resources of the country? . . . The power and world influence of a nation must pass away with the passing of material resources; for poverty is helpless, and ignorance is the inevitable result of continued poverty. Only the prosperous nation can afford the general education or trained intelligence of its people. Old land is poorer than new land. There are exceptions, but this is the rule. . . .

"Nations rise and fall; so does the productive power of vast areas of land. Better drainage, better seed, better implements, and more thorough tillage, all tend toward larger crops, but they also tend toward ultimate land ruin, for the removal of larger crops only hastens soil depletion. To bring about the adoption of systems of farming that will restore our depleted Eastern and Southern soils, and that will maintain or increase the productivity of our remaining fertile lands of the great Central West, where we are now producing half of the total corn crop of the world, is not only the most important material problem of the United States, but to bring it about is worthy of and will require the best thought of the most influential men of America. Without a prosperous agriculture there can be no permanent prosperity for our American institutions."



Deposit exposing a 22-ft. vein of phosphate rock

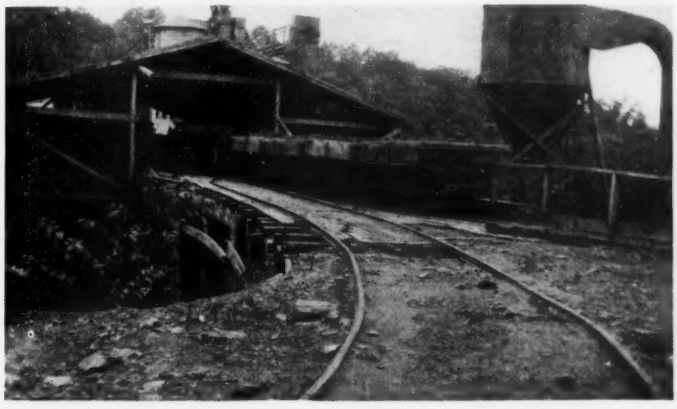
Phosphorus is the master key to soil fertility, and the use of ground rock phosphate in direct soil application becomes more extensive each year. The latest and most modern plant to be erected for phosphate production is that of the Tennessee-Illinois Phosphate Co., at Twomey, near Centreville, Tenn. Its principal purpose is the preparation of ground-rock phosphate for direct soil

View of the phosphate rock deposit

Another vein of raw rock phosphate

application and such refinement in process as will vastly increase its availability in the earlier years of its use.

The plan is the embodiment of the views and research work of George Thomson, president of the Tennessee-Illinois Phosphate Co., assisted by the Malcolmson Engineering and Machine Corp., and reflects the application of entirely new principles in phosphate rock treatment for direct soil application.

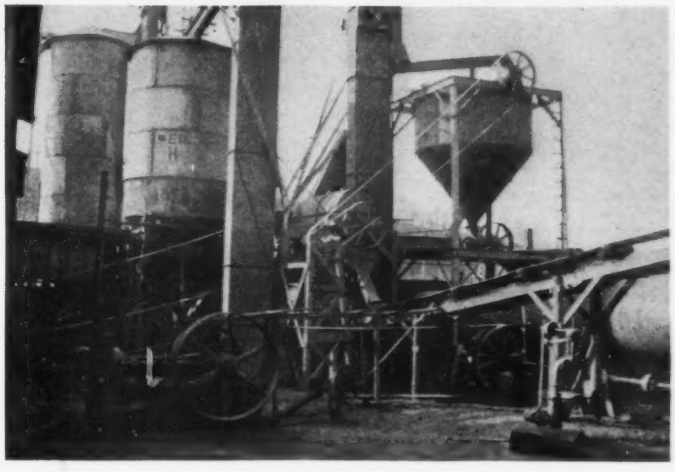


Dumping tram cars into feed hopper of roll crusher

Origin of Phosphate Deposits

The existence of phosphate rock in Tennessee was determined in the early nineties. The Tennessee deposit is one of the three major deposits in the United States. The field contains three distinct measures or deposits, according to age, brown rock, blue rock and white rock. Both of the deposits near Centreville are of the brown and blue rock varieties. The brown rock strata are the thickest of this type in the field—and, geologically, brown rock is considered the most ancient in origin of the world's phosphate deposits, as they are of the Ordivician or lower Silurian measures. At the age of its formation animal life was of primitive forms and no vertebrates had appeared on the earth. The prevailing animal types were more of a gelatinous mass, such as jellyfish and the many minor forms of protozoa and animalculae.

The blue rock measures found in most of this field and above the brown rock are of the Devonian age, at which time in the earth's history the vertebrates and many of the fishes had appeared. While developments have been made on the blue rock, the brown rock, because of its lower cost of recovery, is used chiefly for the production of ground rock phosphate in this field.



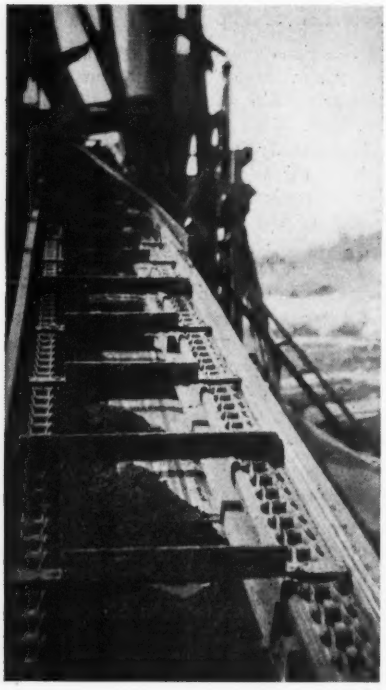
Interior of plant showing engines, drives, bucket elevator, etc.

Formation of Phosphate

Geologists generally subscribe to the theory that these time-aged deposits contain the remains of the marine life of the age, most of which was of minute form and generally of gelatinous structure, such as the various protozoa and other micro-organic forms. At that time it is considered the warm tropical waters of the Southern seas extended over this area of the continent, and that in the various ocean currents that always occur in the sea vast myriads of sea life were brought to these particular regions. This sea life in all likelihood largely inhabited surface water, from which through evaporation and other influences lime was thrown out of solution. In its settling it formed the limestone measures, in which became imbedded the dead micro-organic sea life as the two were simultaneously precipitated to the ocean bed. In time, limestone measures were built

up which contained an unusually large percentage of the remains of this sea life, including some snails, minor crustacea and mollusca, the highest forms of life then reached in animal development.

Sea changes occurred, and intervening between the Ordivician and Devonian ages other measures were deposited, but it would seem that the same influences that concentrated sea life in these regions during the Ordivician age again prevailed during the Devonian, because while in the Centreville region the original limestone formation of both the brown and blue rock contains a high phosphatic residue, yet in other sections of this country where we have the same measures that are supposed to have been simultaneously formed we do not have the high percentage of fossil remains, and therefore do not have the relative phosphatic content.



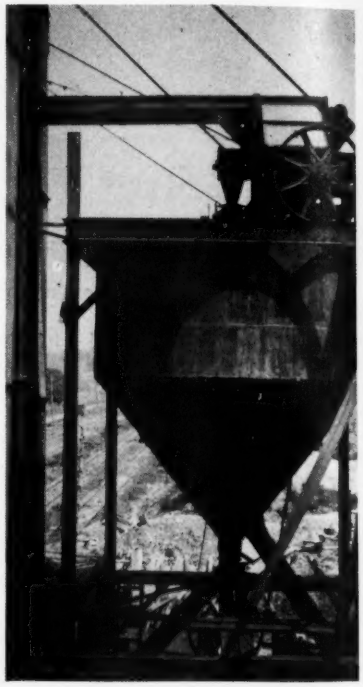
Chain drag conveying wet rock from crusher to drier

Ages afterward this entire region suffered an upheaval which raised it above the sea level. This upheaval was known by geologists as constituting the Cincinnati Arch, its northern boundary resting in the vicinity of Lake Erie.

During the period subsequent to the upheaval much of the measures constituting these deposits had disappeared through erosion and other causes. Fortunately, however, the areas have been left that now comprise the Tennessee phosphate field. The portions of the brown rock seam now being mined are those subsequently leached by the acid waters of vegetative decomposition, during which process the calcium carbonate has been removed, leaving the phosphatic residue. This leaching has not been general, occurring only where the limestone rock was void of silicious cap or covering, which in many places prevented the penetration of the acid-leaching waters. These leached phosphate deposits now contain the original sea-animal remains in petrified form. Many of them are cemented together by silicious material which seem to have become separated from the phosphatic material to some extent during either the period of embedment or later petrification changes, or both. This silicious or coral-like material—which to some extent was evidently secreted by the animal tissues—exists in layers, covering not only these minute animal remains but cementing countless numbers of them into masses, some of which can be crumbled in the hand and others separated only under force. This is mentioned because it is a prime feature that has to be met in the proper reduction of phosphate rock.

Had it not been for the silicious layers surrounding and protecting these phosphatic remains it is more than likely that the acid waters that leached out the surrounding calcium carbonate would have carried away also the phosphatic remains of this ancient sea life, leaving only silicious and other insoluble residues with the impurities carried down by the leaching waters, such as clay, iron oxide and other products of solution following vegetable decomposition.

the seam runs up as high as 29 ft. in thickness of phosphate from which the limestone has been leached. These thicknesses are unusual. The illustration



"Close-up" of the Emerick air separator

showing the seam of the present working face exposes 22 ft. of high-grade rock

Rotary drier and belt conveyor delivering coarse material from screen back to wet rock conveyor feeding the drier

Tennessee-Illinois Co.'s Deposit

The deposits of the Tennessee-Illinois Phosphate Co. are contained in an approximate 400-acre tract of land wherein free from partings or impurities. The average overburden is 12 ft. thick.

When separated from each other the phosphate particles seem distinct, indi-

vidual units. They crush readily between the teeth, illustrating the harder exterior and relatively soft interior. Their outer coating is made up of silica layers and its unbroken presence is a material factor in soil application because of its resistance to the penetration of the weak organic soil acids depended upon for rendering the phosphorus available to plant life. If this silicated outer structure is fractured and broken up on the greater percentage of these particles, then the greater proportion of the rock phosphate mass is available for plant food needs. The problem in rock phosphate grinding is to break up the highest practical percentage of these microscopic phosphate particles, rendering the interior of each open to direct attack by the soil. An important fact about these deposits is that the various forms of minute animal life vary much in relative size, the largest being more than 100 times larger than the smallest. In a portion of the deposit where the smallest particles represent a relatively high percentage of the entire mass, the smallest particles are practically incapable of being ground by reason of their minuteness—they appear in their unbroken form as a very fine powder—and so low in phosphorus content that their removal from the entire mass before grinding is advisable. If they are included with the ground particles of the larger units it is impossible to either bring about a separation or to crush within the practical limits of economic cost.

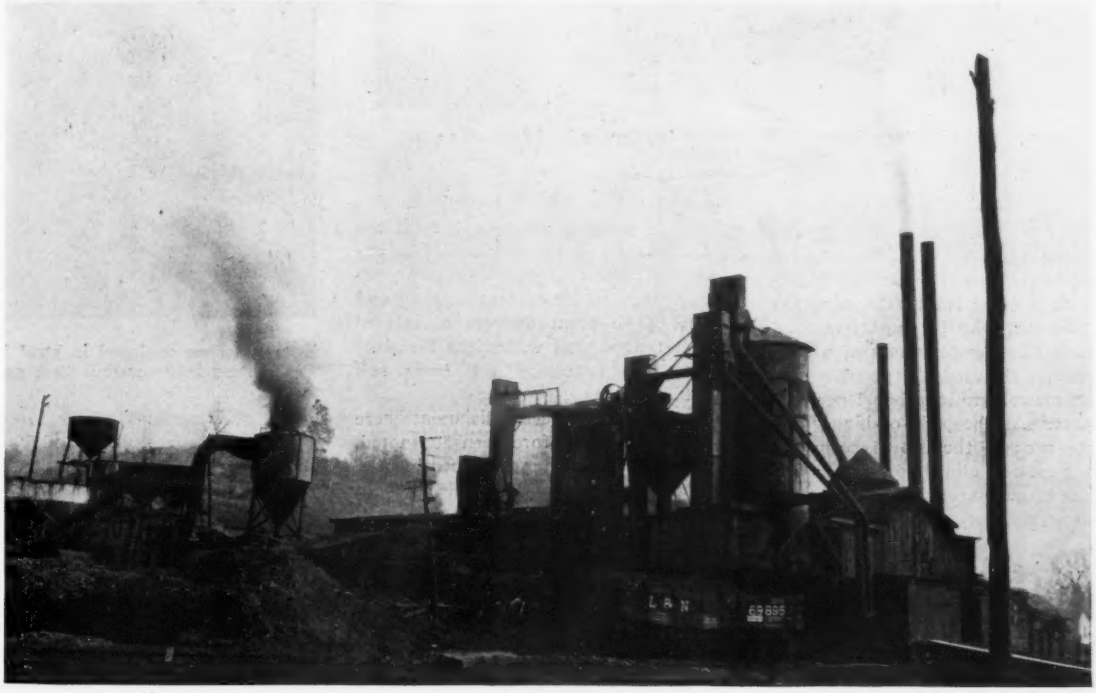
Grinding and Separating Principles

Mr. Thomson's research work before the design and general plan of this plant was determined upon, brought out these facts and they were given due cognizance in the development of the plant. This plant scheme therefore embraces, first, the reduction of the phosphate mass upon drying into the separate forms in which these micro-organisms previously existed. This separation entails the breaking down of the silicious or coral material that both joins them together and forms a coral-like structure, in the interstices of which are held minute quantities of clay or other impurities such as oxide of iron.

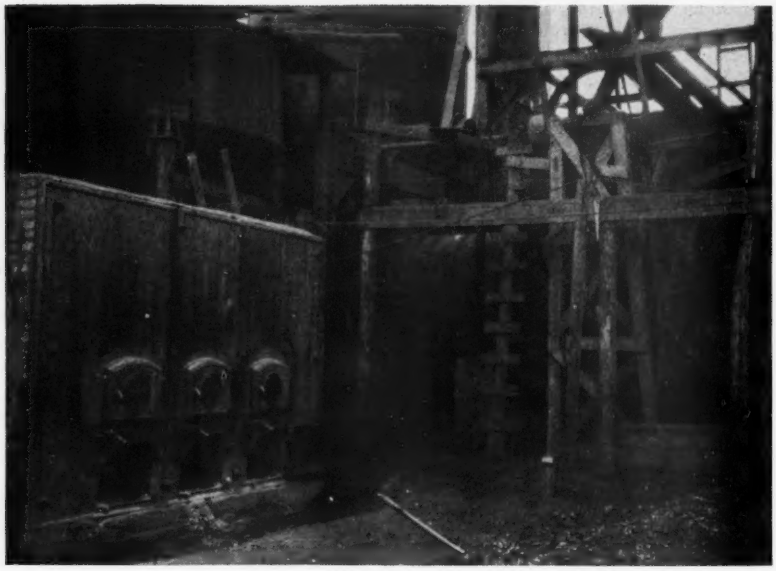
In this shucking or shelling process little chips of coral or silica structure are broken off and by air separation these chips, the very fine phosphatic forms, clay and other impurities are drawn off and separated from the main stream. This leaves a stream of dry phosphatic material free of impurities, silicious chips and the relatively smaller lower grade particles. These particles are of lower grade because the ratio of inner phosphatic content to outer silicious layer covering is less as the particle is smaller. And not only is the particle less in phosphate but the covering is harder and more difficult to grind, entailing costs beyond economic limit.

In handling the stream of purified and higher grade material the problem of cracking or breaking it into very fine powder had to be solved, so that the highest percentage of frustules would be broken. There were several thoughts that presented themselves: These particles were not homogeneous; the inner contents had a different structure and density than the outer layers; therefore in any rub and roll or attrition process of grinding the particles would mesh into each other. If the relatively smaller sizes meshed into the larger the mass would pack instead of cracking, as might otherwise occur with a homogeneous or crystalline structure of particle.

The effect is similar to attempting to grind rosin with the rub and roll method, say, in a mortar and pestle. Another difficulty was that any substance with a silicious covering subjected to friction takes on a charge of static electricity from a conversion of the mechanical energy into electrical energy. Whenever these silica-coated particles are in motion through any metallic system the friction readily creates this charge, and it is only dissipated by submergence in water. This acquisition of a static charge operates in this fashion: The opposite polarity is taken on by the particles of tri-basic calcium phosphate, which constitute the inner contents, so that the particles of the interior of one broken unit immediately arrange themselves over the entire surface of an unbroken unit, with the effect that such covering of fine particles cushions the unbroken one. Building up into charged masses makes the rub and roll method of grinding a great absorber of power and defeats the grinding of



Loading end of plant, Tennessee-Illinois Phosphate Co. Discharge spouts for bulk loading. Note discharge from cyclone



Furnace end of rotary drier. Tube mill in background. View taken during construction

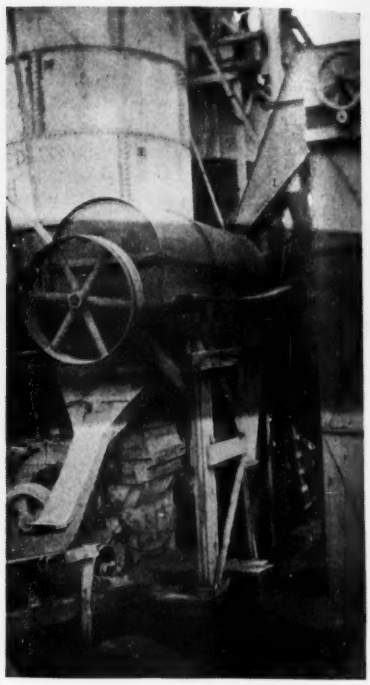
many a particle, and therefore the impact method of grinding is preferable.

The static problem and the problem previously stated, of the particles meshing into each other led to the adoption of the tube mill with its impact method of grinding. The employment of a tube mill, however, required the positive drying of the material to less than 1 per cent of moisture. As the beds of high-grade phosphate rock in the brown seam are porous the rock as mined contains a high percentage of moisture. Further, because of a high percentage of fine particles the material, on introduction to the usual cylindrical form of drier, tends to roll up or cake; this has made uniform drying to low moisture percentages most difficult and uncertain. Therefore the problem of drying had to be handled with positiveness and control, if a tube mill should be successfully employed.

Equipment of Plant

It therefore became necessary to design a special and unusual drier, under such control that the material is dried to less than 1 per cent of moisture. The employment of a tube mill on the range of fine grinding also required a primary reduction before going to the tube mill. To accomplish this an intermediate hammer mill was adopted which prepares the material down to 65 per cent through 100 mesh for tube-mill feed. Further, in tube-mill grinding, by reason of the tendency of the material to pack, the economy of the grinding quickly drops after certain percentages of ground particles are reached. Consequently this meant combining the operation of the tube mill with an air separation process that would remove the ground portion and return the unground particles to the mill. In this separation process, as in the mill, the difficulty of static charge as well as impacting of particles is encountered, requiring ratios of air current velocity and volume. The plant delivers a finished product that is well within the limits of specifications necessary for early soil availability.

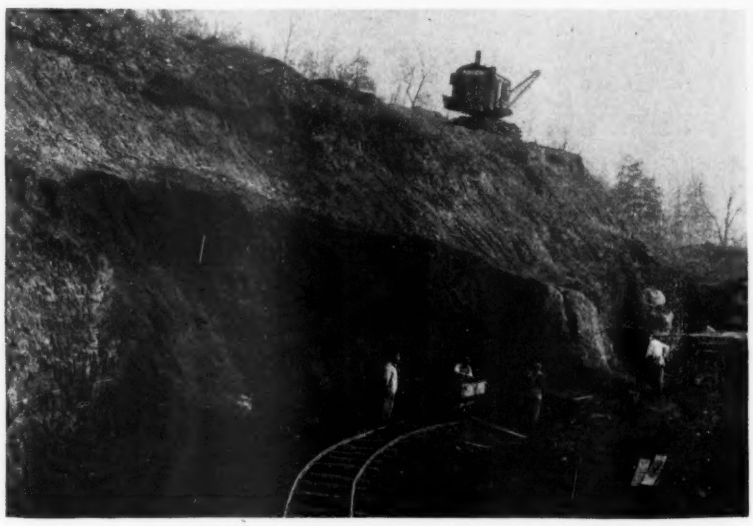
The particular accomplishment here sought had never before been attempted, because the importance of fracturing the phosphate frustules, as distinguished from the mere separation of the smaller frustules, had not been appreciated before Mr. Thomson's research work. It has been particularly gratifying therefore to have a producing plant not only original in design, method and accomplishment, but practical, efficient and economic in regular operation.



Rotary screen enclosed in steel jacket. Williams hammer mill underneath

Course of Material Through Plant

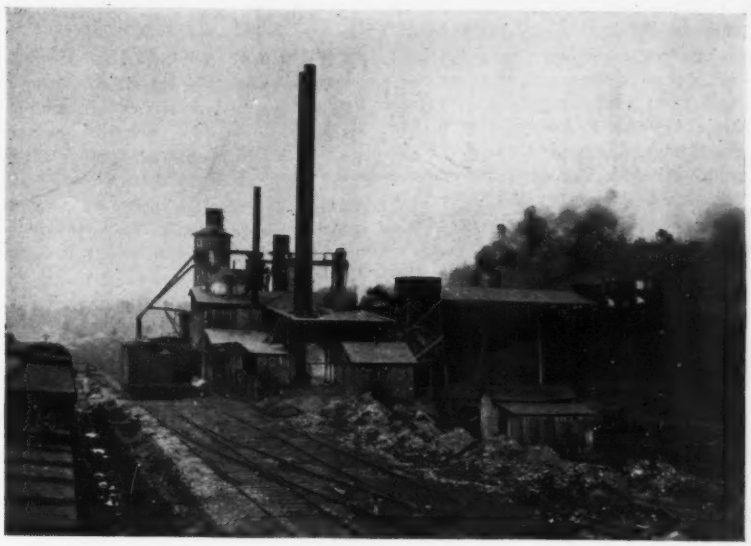
Mining phosphate rock and its preparation in the plant is a continuous process. The phosphate pits are adjacent to the plant. The overburden consists principally of clay and chert, varying from 6 to 20 ft. in thickness and averaging about 12 ft., and is removed by a Model 31 Marion dragline with a ¾ cu.



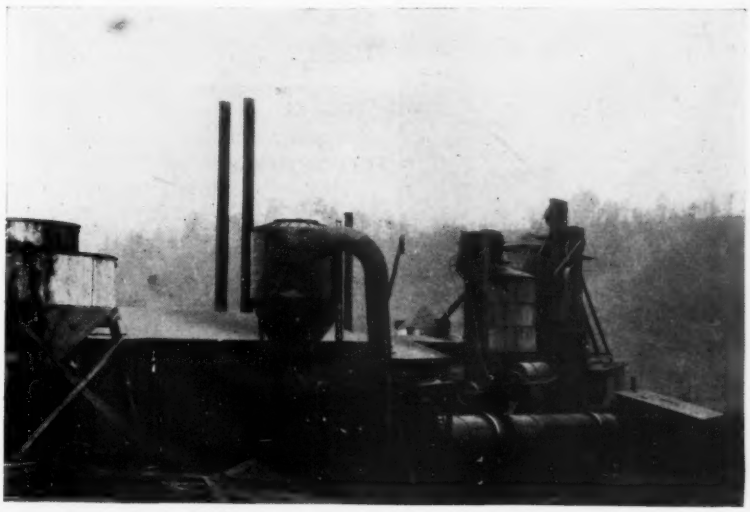
Loading rock phosphate into cars. Dragline for stripping overburden

yd. bucket. The material is rapidly transported to the plant in small trams of the coal-mine type—often known as "butcher cars"—of two-ton capacity, 36 in gage end dump. The phosphate, while in a thick seam, is mined by hand to avoid mixing clay or impurities in the rock; this is unavoidable when loading by steam shovel. The cars are hauled by mule over 16 lb. rail to the crushing plant, where they are automatically end dumped into a hopper, the wet rock entering a differential two-roll crusher. This differential in roll speed prevents adherence of the raw phosphate muck, especially when an excess of moisture is present. This crusher, manufactured by the Patterson Foundry and Machine Co., East Liverpool, Ohio, discharges into a hopper, from which the phosphate is conveyed, and uniformly fed to the drier.

The drier, of the single-sheel, direct-fired rotary type and fed at the cold end, is provided with an exhaust fan for handling the gases and moisture. This fan discharges into a cyclone separator which reclaims the dust picked up by the gases in passing through this drier, and is necessary because of the low exhaust temperature of the moisture-laden gases. A positive feeder is provided for feeding wet rock to the drier and at the same time prevents the air from entering with the exhaust gases, thus affording a continuous check-up of operation. The drying equipment is very efficient because the operator knows exactly what is taking place at all times and has means for controlling any of the conditions which affect the results. The installation



Loading end of plant. Note spouts for bulk loading and ample storage for railroad cars



The plant of the Tennessee-Illinois Phosphate Co., Twomey, Tenn., during construction and before erection of super-structure

the material; this would directly affect the efficiency in the operation of the drier.

The specially designed furnace has Hulson shaking grates and the means for regulation of the air necessary for combustion and carry off the moisture after evaporation. A Taylor recording high temperature pyrometer records the temperature of the gases where they enter the drier and a Foxboro recording thermometer records the temperature of is a well-balanced combination of drier, furnace and control equipment, of correct design and able to perform continuously to insure the most thorough and economic drying.

Another function of the cyclone is to remove some of the objectionable clay and small, low-grade frustules from the phosphate rock, thus increasing the grade of the finished product.

After drying the rock is elevated to a revolving screen which passes all material ¾ in. and under to a Williams hammer mill. The oversize from the screen is returned to the feed end of the drier by a belt conveyor. This material keeps the wet rock from sticking to the drier shell at the feed end and the pieces are reduced in size and thoroughly dried during the second trip through the drier.

After the hammer mill reduces the phosphate rock to approximately 60 mesh and under the material is then elevated and conveyed to an Emerick air separator where the 200-mesh material is separated. The oversize is elevated to the tube mill storage bin from which it is fed uniformly to an Allis-Chalmers 6x15 ft. tube mill. The discharge from the tube mill is elevated to the air separator, mixing with the material coming from the Williams mill. Thus the two mills are in closed circuit with one Emerick air separator.

By certain combinations of elevating and conveying equipment the material discharged from the tube mill can be put direct into the finished product bins or loaded into cars for shipment. Each of the two elevators taking material from the separator and tube mill are equipped with a chute with a flexible spout for loading out finished material in cars on two loading tracks. Provision is also made to divert the material from the separator and tube mill to a small bin which feeds a two-compartment Bates valve bag packer. The bags are conveyed from the packer direct to cars or to storage by means of a reversible belt conveyor. The small bin feeding the packer is equipped with a special screening screw conveyor for removing all foreign matter

and provides protection for the mechanical parts of the packer

The power plants consists of two 72 in. x 18 ft. Chandler & Taylor quadruple-riveted, return-tubular boilers set in battery, with individual stacks and Hulson shaking grates in special furnaces designed for economically burning the coal without any smoke. The steam pressure is 150 lb. A 13 in. x 14 in. Ames automatic engine drives the roll crusher, wet rock conveyor, drier, exhaust fan and drier elevator. The operation of this equipment is independent of the main power and grinding plant. A 16 in. x 42 in. Allis-Chalmers heavy-duty Corliss engine drives the Williams mill, tube mill and the other auxiliary equipment. A 10 in. x 12 in. Brownell slide-valve engine operates the bagging and loading equipment at such times that it is necessary to load cars when the plant is not operating. There is also a 12 in. x 14 in. Erie slide-valve engine near the Ames engine for emergency purposes. In time of trouble with the Corliss engine it is possible to operate the entire plant, except the Williams mill and tube mill, by the Ames engine. The main drive shaft and Corliss engine are lubricated by an automatic oiling system furnished by the W. W. Nugent Co., Chicago, Ill.

The drying and pulverizing equipment is of particular interest as this is the first successful tube-mill installation for pulverizing phosphate rock in the Tennessee field. Fine grinding in a tube mill is absolutely contingent upon thorough drying, which in turn depends upon the efficiency of the drying equipment. Thorough drying is essential, however, for efficiently operating any kind of pulverizing equipment.

The plant was erected under the supervision of William Rinehart, the present superintendent. The product is being marketed under the trade name, "Four Leaf Phosphate," by the Thomson Phosphate Co. George Thomson is president of both the Tennessee-Illinois Phosphate Co. and the Thomson Phosphate Co., of Chicago, Ill. He formerly controlled large coal mine interests. The Malcolmson Engineering and Machine Corp., Chicago, Ill., which collaborated with Mr. Thomson in designing the plant and equipment, are well known for their work in coal briquetting and special engineering.

Big Order for Concrete Brick

THE San Fernando Valley Concrete Construction Works of San Fernando, Calif., has received a contract for 650,000 concrete bricks for the American Aluminum Metal Products Co. of Burbank. One-fourth of the order calls for granite faced bricks. The remainder will be entirely of concrete.

Iowa Sand and Gravel Producers' Annual Meeting

Association Will Employ Paid Executive Secretary in 1922—Extension of Activities Planned

THE annual meeting of the Iowa Sand and Gravel Producers Association held at the Savery Hotel, Des Moines, Iowa, on January 4 and 5, proved conclusively that if the Iowa Association were to extend its activities and increase its membership, it would be necessary to employ a paid executive secretary who would be able to devote his entire time to association work.

The year of 1921 was a period of acid test for the association and the fact that

President R. C. Fletcher

it held together was due to the efforts of R. C. Fletcher and Gaylord Gray, president and secretary of the association, respectively. However, the annual meeting manifested good spirit and a will to cooperate, and it is hoped that the year 1922 will bring the association through with flying colors.

January 4 was originally set as the date on which the association intended to present its case on commodity rates and minimum carload weights on sand and gravel, but this hearing was postponed indefinitely and the day was devoted to a resume of the association's rate case and a review of the data on hand. Mr. Gray and Mr. Fletcher, who were greatly instrumental in the preparation and accumulation of data, did the explaining. A series of graphs and charts have been prepared which show Iowa rates in comparison to rates in effect in other states. Each rate is represented by a curve, forming an exceedingly interesting as well as conclusive exhibit. Jude Henderson, Commerce Council, Iowa Board of Railroad Commissioners, and Mr. Wylie, Freight Commissioner, Greater Des Moines Committee, both complimented the association on its splendid work, and also gave a brief outline of the program for the rate hearings. It is without a doubt that with so convincing a set of exhibits the association cannot fail to impress the railroad commissioners and in all probability its plea will be granted. Quoting Mr. Wylie, "Figures never lie, but liars can figure."

V. O. (Organization) Johnston, president of the National Association of Sand and Gravel Producers, was one of the guests of the convention. Mr. Johnston made a splendid address on what organization of the industry had accomplished and also described the progress made in the industry during the last year.

The session on Thursday was devoted to a discussion as to the advisability of employing a paid executive secretary, the fixing of a budget for 1922 and the annual election of officers. The question of an executive secretary was discussed pro and con and it was finally decided to instruct the executive committee to employ a secretary just as soon as possible. In the meantime, it was decided that the association obtain the services of F. A. Laughead, newly appointed field secretary of the National Association of Sand and Gravel Producers, for the purpose of going over the ground in Iowa as a preliminary to getting the permanent secretary. Mr. Laughead will be able to furnish the association an idea as to what can be expected from a permanent secretary, and although his work in Iowa will be short, it is expected that he will do a great deal toward increasing the membership. The association also decided to obtain Mr. Laughead's services again at a later period, in order to break the permanent secretary in on his new duties.

R. C. Fletcher, president of the association, was re-elected in view of his splendid work during the past year. Mr. Fletcher is vice-president and general manager of the Flint Crushed Gravel Co., Des Moines, Iowa. J. W. Pichner, secretary and treasurer, King's Crown Plaster Co., Cedar Rapids, Iowa, was elected vice-president, and Gaylord Gray, Des Moines Sand and Fuel Co., Des Moines, Iowa, was re-elected secretary-treasurer.

pending the appointment of a permanent paid secretary. The executive committee elected consists of G. H. Boynton, Northern Gravel Co., Muscatine; Roy Smock, Cedar River Sand and Material Co., Waterloo, and L. E. Duvall, Sabula Sand Co., Sabula.

In view of the fact that the association intends to increase its activities and consequently a greater budget will be required, it was decided that the dues for 1922 shall not exceed 10 mills on the tonnage produced in 1921, or so much of 10 mills as will be required to carry association activities through 1922.

Indiana Sand and Gravel Producers' Annual Convention

Prospects for 1922 Favorable—Splendid Spirit of Co-operation and Friendship Feature of Convention—Association Firmly Established

ENTHUSIASM, co-operation, good-fellowship and industry marked the seventh annual convention of the Indiana Sand and Gravel Producers Association, held at the Claypool Hotel, Indianapolis, Ind., on January 10 and 11. It was considered by all members as a most satisfactory meeting, one to be remembered for its good cheer and good-fellowship and primarily for the valuable exchange of experience and data.

In his opening address M. A. Neville, president of the association, reviewed the year's work. He stated that business last year had not lived up to their expectations and that profit had been relatively light; that it was necessary to devise more efficient ways of producing sand and gravel, and while the outlook for 1922 was very favorable, that greater co-operation would be necessary if the association and its members would be prosperous. Mr. Neville briefly reviewed the work done in handling freight-rate problems and the dealings with the State Highway Commission; he expressed faith in the increased use of graded sand and gravel and urged members to co-operate more closely in the production of good graded material.

R. C. Yeoman, extension engineer for the association, made his annual report, reviewing the work done by the association in 1921 and plans and suggestions for activities in 1922. In the report, Mr. Yeoman stated in part:

Specifications: Economic conditions and specifications seem to have some relationship. For two or three years past, when there were car shortages and the supply of material limited, specifications seemed to be too rigid. Efforts were made to loosen specifications to include a greater variety of material. Now that economic conditions have changed and there are plenty of cars and plenty of material, the tendency is to raise the standards of quality and tighten up specifications. It seems to me that the position the association has taken, specifications should consider conditions surrounding production, is a logical one. More has been done in Indiana than in any other state to bring about this relationship.

County specifications have in many cases been changed to allow the use of local pit-run materials in order to avoid high freight rates. The State Highway

President M. A. Neville

Maintenance Department has followed the same practice. Early last spring officials were somewhat resentful to suggestions from interested parties that the quality of materials should be kept up. A season's use of road-side material has done much to convince these officials of the danger of this practice. In a number of counties, contractors have been stopped from building roads with inferior materials by complaints from interested taxpayers. These actions indicate a favorable state of the public mind toward high-grade materials and now the time is more opportune than ever for the systematic promotion of this idea.

Inspection: The inspection of materials has been carried on in two ways—at the plant and on the job. The plant inspection reports have been very satisfactory, but the road inspection has had a number of aggravating cases. Most of them called to my attention were settled satisfactorily. One particular case, which came too late, was lost. The policy of the association has been to wait until trougle has occurred and then try to correct it. It has been suggested that in the future some means be devised as a preventive. Plant inspection is the one most acceptable, but the Indiana commission does not feel disposed to spend the money to have that done. In the inspection of higher grade manufactured articles than sand and gravel, such as steel, cement, etc., it has been the practice to test the material at the plant.

Along this line I have thought out the principles of a device whereby the sand and gravel producer could quickly test a carload before it goes out, and at the same time make a record of the test to accompany the bill of lading. In order to make it practicable, the apparatus is designed with few working parts, ruggedly constructed and simple to operate. With this device I am confident that a carload of gravel or sand may be tested wet and a satisfactory report made within two or three minutes. It has been my intention to construct such an apparatus, but lack of time and funds have prevented.

Promotion: Numerous short trips were made throughout the state, visiting county officials, particularly surveyors and road superintendents and commissioners. Reception was always cordial and suggestions were received with considerable interest. However, the commissioners complained bitterly of excessive transportation cost and felt that because of the relative values of farm produce they could not afford to use shipped materials when local gravel was available.

There is no question but high-grade materials are wanted, but the universal agitation for economy forced the officials to accept inferior materials in order to cover more territory.

The Allied Motors Commerce, a new organization which has for its purpose

the handling of motor truck interests, has expressed its desire to affiliate with this association. Like many other organizations, it came into existence in defense of its rights. The 1919 motor vehicle law and the Indianapolis truck license ordinance conflict, putting an unfair burden upon truck owners. These laws have been contested and it appears that the truckmen have had some success. However, lately they have come to the conclusion that a movement towards a system of good roads is a greater issue than the one of application or amount of license. They have decided to drop their fight on the present laws and co-operate with the various agencies in proposing amendments to the present law which will eliminate their objections and further to create a larger fund for highway expenditure, this additional fund to come from the motor vehicle users.

There is more to be done in the promotion of sand and gravel combined with various road binders, such as calcium chloride, refined tar and asphalts. Calcium chloride is new in this state, except for a few places in the larger cities. It is only this year that it has been available in quantities to make it cheap enough to use. It is expected that next year much of it will be used in this state.

Emulsified asphalt is the only asphalt preparation that has come to this state that will bind sand and gravel. There is a stationary plant in the city of Indianapolis that mixes sand, gravel and asphalt and ships to any part of the state. There has been constructed an emulsified asphalt mixing plant on board of a car that may be shipped to your plant and ready mixed asphaltic concrete be made there, saving one freight rate.

Agricultural Sand: During the past few years some experiments have been conducted, using sand agriculturally to improve the soil. The experimenters are amateurs and have not made careful records of their work, consequently definite data cannot be presented. One man whom I visited had been a commercial fertilizer agent for 22 years. Four years ago he quit the use of this material and began using sand and humus, humus being that fine, black loam which is found in river bottoms and contains a large percentage of organic matter and some nitrogen. He has used from 200 to 400 lb. to the acre of half-and-half mixture when applied to a hill or row. When sown broadcast, from one to two tons per acre is put on. He reports improving a certain piece of land from a yield of 45 bu. of corn per acre to 65. This combination seemed to work best in the more clayey soils south of Indianapolis.

The sand in this section contains a little more than one-third lime, which acts as an acid neutralizer. There are other ingredients, including a small amount of potash and several compounds of silica, which are claimed to have peculiar values. Plans are now under way to make a scientific test of these materials, having an official observer from the county or state. The experiment will be made under practical conditions on a full size farm, and comparisons made with and without these materials, and in comparison with commercial fertilizer. It is hoped by next year we will have some tangible and reliable data to offer.

Laboratory: The testing laboratory installed by the association over a year ago has completed about 100 tests this year. Practically all of them have been screen analysis made at the request of producers and public officials. The exact value of these tests cannot be estimated. In some cases they have assisted in modification of inspection and effected a saving of material. In others, the benefits are mainly potential. They serve as a check upon the official or contractor who would be unreasonable if they knew they would not be opposed.

Regarding the future activities of the association Mr. Yeoman made the following recommendations:

1. A legislative committee be appointed, consisting of five members at least, in order to more efficiently cover the large territory. That each district be organized to get in close touch with legislators for next session. Invite legislators to visit plants in person and explain to them the importance and needs of the industry. The committee will meet from time to time, propose and approve or disapprove legislation.

2. That the extension engineer inspect and test road construction materials and specifications over wide territory, and particularly when requested by an individual producer; report same to executive committee by mail or at meeting, and make such protest to officials when the best interests of the association may be served.

3. That a permanent exhibit be prepared and kept at state headquarters to be used at fairs, conventions and the road school. This exhibit to advertise the advantage of washed and screened sand and gravel.

4. That the rate book started for the Indiana Highway Commission be taken up again as soon as the freight-rate situation is cleared, and this work completed and copy sent to each member.

5. That the scientific experiments in the use of sand alone or in combination with humus be sponsored by the association and every assistance given to investigate this matter to find out just what is the agricultural value of sand.

6. That effort be made to have the county commissioners, road superintendents and county engineers of every county where there is a market for association producers, to inspect an up-to-date sand and gravel plant and be thoroughly acquainted with the advantages of the material.

7. That a standard and ethics committee be appointed for the purpose of devising some simple rules to be adopted by the association that will form a basis for a higher plane of activities and business dealings.

The afternoon of January 10 was devoted to a business session during which the following resolutions were drawn up:

1. That the minimum dues be $50 per year and that the assessment for trucking plant members be 50 per cent of the assessment for commercial shipments by rail, viz., five miles per ton.

2. That the association become a member of the Allied Motor Commerce of Indiana, the membership dues of which are $1 per year for each delivery truck owned by a member of the association.

3. Following an address on "Freight Rates and Car Supply," by E. Guy Sutton, executive secretary for the National Association of Sand and Gravel Producers, the association went on record as approving the program of the national association in its fight for a reduction in freight rates before the I. C. C.

New Officers

The officers elected for 1922 are as follows: M. A. Neville, Western Indiana Gravel Co., Lafayette, re-elected president; George J. Nattkemper, Summit Sand and Gravel Co., Terre Haute, re-elected vice-president; Jesse Shearer, Indiana Gravel Co., Indianapolis, secretary and treasurer. Members of the board of directors: W. S. Baird, Mt. Carmel Sand and Gravel Co., Mt. Carmel, Ill., and H. E. Neal, Neal Gravel Co., Indianapolis.

Wednesday, January 11, was an open meeting and addresses were made by Ben H. Petty, highway engineer, Purdue University, on a "Survey of Road Materials in Indiana; A. H. Hinkle, chief engineer, maintenance, State Highway Commission, on "Prepared Gravel for Road Maintenance"; Fred Kellam, chief, Bureau of Tests, State Highway Commission, on "Why Specifications?"

At a luncheon given by the association, Earl Crawford, member State Highway Commission, spoke on the "Farmers' Interest in Highway Transportation."

Make Early Reservation for New Orleans Meeting

AS THE annual convention of the National Association of Sand and Gravel Producers at New Orleans on February 1, 2 and 3 comes at the height of the Southern tourist season, it is probable that the hotel accommodations in that city will be more or less limited. Secretary Sutton therefore asks that reservations be made as soon as possible, either through his office or by writing direct to the hotel desired.

National Agricultural Limestone Convention

Open and Frank Discussion Dominates Annual Meeting—Bright Prospects for Agstone Products in 1922

THE annual convention of the National Agricultural Limestone Association held at Columbus, Ohio, January 11, 1922, proved to be one of the best in the history of the association and was marked by an unusual open and frank discussion participated in by all members, and the meeting closed with more good-will and confidence existing between producers than ever before. The enthusiasm shown and the uplift of personal contact between producers were the outstanding features.

The officers elected for 1922 are as follows: E. M. Lamkin, Kelley Island Lime and Transport Co., Cleveland, Ohio, president; R. J. Fuller, Columbia Products Co., Cleveland, Ohio, vice-president; W. H. Hoagland, Marble Cliff Quarries Co., Columbus, Ohio, treasurer; A. P. Sandles was retained as secretary and Claude L. Clark as assistant secretary. The board of directors consists of J. C. King, Carbon Limestone Co., Youngstown, Ohio, chairman; Harry Brandon, Ohio Marble Co., Piqua, Ohio; Clyde Calvin Bessemer Limestone and Cement Co., Youngstown, Ohio; Frank Colgan, Colgan Limestone Products Co., Columbus, Ohio; W. M. Brown, France Stone Co., Toledo, Ohio; Thos. McCroskey, American Limestone Co., Knoxville, Tenn.; E. M. Lamkin, R. J. Fuller and W. H. Hoagland. Two more directors are yet to be elected, one to be chosen from Indiana and one from Pennsylvania.

A dinner was provided for by the Marble Cliff Quarries Co., at which four representatives of the soils department of Ohio State University made addresses. The general trend of their talk was that practically 90 per cent of all farm lands in the country needed agricultural limestone; that the farmer was slowly but surely finding out that agricultural limestone paid bigger and better dividends than any other investment he could make. Also, that farmers using commercial fertilizers would get double value from it, if it were used with agricultural limestone.

Agricultural limestone producers do not claim that their product is a cure for all ills found on a farm; there must be proper drainage, crop rotation and other practical methods used in farming in order to get the best results from the use of agstone. The producers present at the convention agreed to furnish free agstone for all demonstrations conducted by the soils department of the Ohio State University, provided these soil tests are made to determine how much agstone should be spread per acre to neutralize soil acidity. This action was taken in order to make sure that agstone is given a fair chance to prove its usefulness as a soil corrective and crop booster.

The soil experts present at the convention urged producers to promote the idea of storage bins. The Ohio State University extension workers are promoting this idea very vigorously and they desire to have the co-operation of agricultural limestone producers in this matter.

F. A. Sebring, chief inspector, Ohio State Bureau of Feeds and Fertilizers, addressed the convention and agreed to assist the members of the Agricultural Limestone Association in establishing high standards of quality for their product. Mr. Sebring reported that his department had already brought action against and stopped certain brokers from selling worthless material from which farmers derive no beneficial results and from which producers of good quality limestone indirectly get a black eye.

It was further brought out that reports received by the association officials indicated that the need and use of agricultural limestone is being discussed at many farm institutes, farm bureaus, granges and other rural meetings. The future for agricultural limestone looks brighter now than ever before. The agstone industry is no longer an infant. The product is now given a place under its own name on the commodity list of the Interstate Commerce Commission.

In many localities the agstone idea is sold to the farmer 100 per cent, but vast areas of farming sections in the country are yet awaiting its message. Belief was strong in the mind of every person present at the convention that within a few years every successful farmer would look upon and use agricultural limestone as a part of his farming program.

In the matter of freight rates the convention was advised that the Interstate Commerce Commission had scheduled January 28 for hearings on a reduction in rate on agricultural limestone. A. P. Sandles was instructed to represent the association at this hearing and present argument as to the necessity of reducing rates on this commodity. Mr. Sandles will work in co-operation with the American Farm Bureau Federation and the utility commissions of several states in his fight for a reduction in rates.

It was also brought out that the freight rate action of some utility commissions on intrastate movements gave rise to many inequalities when agricultural limestone producers crossed state lines with their product; this inequality made more necessary the action of the I. C. C. for a general rate reduction.

The budget for association activities in 1922 was absolutely guaranteed by the convention. This action puts the financial affairs of the association on a very substantial basis.

In the course of the meeting a very interesting discussion between producers and soil experts took place as to the results obtained by using agstone of different degrees of fineness, including screenings, on soils. The soil experts said that experiments are being carried on along these lines at the present time, but that finely pulverized limestone will give quicker results and neutralize soil acidity almost upon contact with the soil, but that splendid results for money spent had also been obtained by use of agstone meal and screenings.

The association plans to increase its associate membership and also to keep in closer touch with state and national organizations, such as farm bureaus, granges, etc. So much interest has been aroused in agricultural limestone work that the association receives almost daily inquiries from teachers at agricultural colleges for information on agstone and requests for the association organ, "Dollars and Cents." The association has just received an order for 10,000 copies of "Dollar and Cents" from the Ship Canal Portland Cement Mfrs., Ltd., of Ellismere Port, England. This company has offices and warehouses in London, Liverpool, Cardiff and Dublin and manufactures an agricultural limestone which it markets under the trade name of "Carbo-Limo." The company plans to use "Dollars and Cents" for the promotion of agricultural limestone in England. The association has also received requests for "Dollars and Cents" from Germany. The widespread attention that this book is receiving and the splendid work it is doing in promoting agricultural limestone is due to A. P. Sandles, secretary of the association, and Claude L. Clark, his assistant.

Central Freight Association Hears Complaint of American Sand Association

A BRIEF but very interesting hearing was held before the traffic committee of the Central Freight Association at the Chicago offices on January 10. President F. R. Thrall, of the Geauga Silica Sand Co., Cleveland, presented the case of the Association, assisted by Hubert B. Fuller, the Association's secretary and counsel. Chairman Morris of the traffic committee presided.

"We are here to assure you that we are your friends," said President Thrall, "and to ask that our plea for more equitable rates on silica sand be received on its merits. But we are here first of all to enter our protest against the standpoint of the carrier that preferential rates on sand are justifiable. Sand is sand, and I defy any traffic man to correctly name the grade or the purpose of the several sands which I shall, with your permission, offer as an exhibit."

Assisted by Secretary Fuller, President Thrall displayed on Chairman Morris' desk some 20 varieties of sand without labels or other identification marks. Great interest was displayed by the traffic men in this exhibit, all crowding around the table and asking numerous questions.

"Now, gentlemen," said Mr. Thrall, "here are sands for road-building, for foundry work and for the manufacturing purposes. Which is which? To know definitely, I must refer to my list, my key, for the answer."

After an interesting discussion as to how these several exhibits were applied in the industries, Mr. Thrall said:

"This situation supports our contention that sand is sand; that all sands should be so considered by the carrier, and that they have no more right—as they have no knowledge—to place a high rate on silica sand than they have to place a low rate on road-building sand, and this, as you know, has been done. Sand is sand to all intents and purposes while in transportation. Why therefore should you traffic men make this discrimination?

"You are losing a great deal of business, and we are losing a great deal along with you. We don't want to fight; we have no threats of appeal to make to the Interstate Commerce Commission. We want to work with you as friends and business associates. Preferential rates on sand have no foundation in fairness and we hope that you will see the justice of our contention."

Rates on like qualities of sand and discriminations made in specified cases of unequal tariff were also discussed, President Thrall quoting from a lits of court decisions and tariff lists in defense of his contentions.

T. J. McLaughlin, of the traffic department of the American Radiator Co., with three major plants and subsidiaries covering all sections of the country, told the traffic committee of the extent of his company's operations and wherein sand entered into its products. The committee "sat up" when Mr. McLaughlin related that his company instructed the sand producers to ship all sand as "Lake sand," no matter for what purpose it was to be applied after delivery to the manufacturer. No differentiation of rates could then be made as to its grade or purpose. Mr. McLaughlin's talk was received with approval by the Association representatives present and was believed to have found weight with the committee.

Other representatives of the Association and allied industries were present, but, as President Thrall said, "We will not take up the time of the committee to hear these gentlemen, as we feel that you have had our case fully presented and that you will accord us the justice we seek at your hands." Chairman Morris assured the Association representatives that the committee would give an early reply to their plea.

CALENDAR OF COMING MEETINGS

AMERICAN ROAD BUILDERS' ASSOCIATION and GOOD ROADS SHOW, annual meeting, at Coliseum, Chicago, January 16, 17, 18, 19, 20.

NATIONAL CRUSHED STONE ASSOCIATION, annual meeting, Chicago, January 16, 17, 18.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, annual meeting, Cleveland, Ohio, January 17, 18, 19.

SAND-LIME BRICK ASSOCIATION, annual meeting, Dayton, Ohio, February 1 and 2.

NATIONAL ASSOCIATION OF SAND AND GRAVEL PRODUCERS, New Orleans, La., February 1, 2, 3.

Wisconsin to Produce 7,000,000 Tons of Aggregate in 1922

IN HIS letter of December 31, 1921, Secretary Hubbard of the Wisconsin Mineral Aggregate Association says that Wisconsin has 441 miles of highway to be built in 1922 requiring 2,000,000 tons of aggregate. The road program is 25 per cent in excess of 1921.

"Last year," said Mr. Hubbard, "35 per cent of the cement shipped into Wisconsin was used for highway work. The average used over the whole United States was 23 per cent. In Wisconsin, this means that 65 per cent of the cement shipped was used for other purposes. As cement is used only in concrete, requiring aggregate, we can assume that about the same proportion of our materials was used in other than highway work.

"If the same parity in percentage is maintained in 1922 highway construction as against all other construction and 2,000,000 tons will be required in this highway construction, then approximately 4,000,000 tons will be used in other than highway construction, in 1922. These 6,000,000 tons are based on road and other construction now known and if the program is further increased as the season advances, then the total requirements of aggregate will be increased. This is production required for construction in Wisconsin only.

"When we add to this tonnage the amount shipped from the Janesville, Beloit, Waukesha and Racine districts, into Illinois, it is safe to assume that the producers of Wisconsin will be called upon in 1922 to produce and take care of business requiring 7,000,000 tons."

Free Information About Laboratory Construction and Equipment

THE Research Information Service of the National Research Council is prepared to supply to those interested information about scientific instruments, apparatus and supplies, laboratory construction and equipment. All requests should be addressed to the National Research Council, Information Service, Washington, D. C.

No State Cement Plant for Pennsylvania

CONTRARY to all existing rumors that the State Highway Department of Pennsylvania has in contemplation the erection of a state cement plant, comes this authoritative statement from G. G. Hatter, executive manager of the department to ROCK PRODUCTS:

"The State Highway Department of Pennsylvania does not contemplate the erection of a state cement plant. As you know, we are in the midst of the cement district and therefore would not have the advantage which other states not so situated might have in this respect."

Editorial Comment

Look to Your Costs!

A large number of producers in the rock products industry have doubtless dismissed the year 1921 with a fervent "Thank Heaven, it's over with!" It certainly fell far short of expectations; and having just re-read the predictions of a year ago, we feel that the better part of wisdom is to refrain from any now. We agree with the sentiment of several producers that this year of 1922 will be better because it can't be worse than 1921. On the other hand, many producers had quite a prosperous season. In New York, Pennsylvania, Ohio, Wisconsin, and some of the other Northwest States mineral aggregate producers generally had a good business. Ohio and Wisconsin lime producers had a very fair business. Gypsum producers nearly all had a profitable year. Cement producers equalled their record year of 1920, but at somewhat reduced prices.

There was considerable activity in the construction of new plants in 1921. The $2,000,000 cement plant at Petoskey, Mich., was perhaps the most notable in the whole industry. Other new cement plants are in process of construction. There were a considerable number of new quarry plants, probably the most important being that of the Mesabi Iron Co., in Babbitt, Minn., which is not yet completed. Many new gravel plants were built, the most important developments, perhaps, being the two new Ohio plants of the Greenville Gravel Co. A really revolutionary development in rock phosphate plants is described in this issue. In the lime industry the completion and operation of the new plant of the Rockland and Rockport Lime Corp. was undoubtedly the most important development.

Our records show that much new construction is contemplated for this year, in spite of all the handicaps that surrounded the industries in 1921. There is an almost universal belief that we are proceeding toward healthful, stable and prosperous conditions by sure and cautious steps. All things considered, a period threatening widespread disaster to many industries was passed with remarkably few failures. Unquestionably this was due to a better understanding of all the factors involved and the successful efforts of producers to keep their production within bounds and to demand a price commensurate with the cost of production.

That this policy is a helpful one, in spite of the attempts made by outside pressure to change it, is certainly evidenced by the experience of business men generally in the year 1921. No industry ever gave its product away, either to its own advantage or for the public welfare. A business that cannot show, except in extraordinary instances, a balance on the right side of the ledger is just as much a pauper and a drag on society as any individual imbecile.

And we think these remarks are relevant as applied to 1922 business because the most careful observers believe that business will be slow picking up in the spring—as it was last year. Everybody wants to be assured that prices and wages are fairly fixed for the year before "turning on full steam." Therefore a heavy responsibility rests with producers of all building materials to contribute stability and confidence. The only way this can be done is by gaging prices with production costs and not by trying out theories of driving people into buying at once by kiting prices.

The most plausible explanation of the present building situation we have seen comes not from high-brow theorists in Washington and elsewhere, but from a hard-headed Ohio contractor, who says that stability in 1922 means slowly but steadily receding prices and "a firm determination to give service for a reasonable profit and to see that every element of cost comes under that rule." He points out that as prices declined, more and more jobs would come within the range of investment possibilities. The reason there is practically no building now except houses and apartments is because high rentals either drive people to building homes or offer extraordinary inducement to investors. Few other lines of business are sufficiently prosperous that they can build at present levels and compete successfully with enterprises established under pre-war levels; but slowly receding prices, based on actual savings in cost of production, will somewhere meet reviving business in other lines—and the two will merge to make for real national prosperity.

Lime and Tuberculosis

No general inquiry ever sent out to the lime industry by ROCK PRODUCTS aroused such general and active interest as the one from which the article elsewhere in this issue on "Lime and Tuberculosis" is based. That interest was founded on the sympathy each and every one of us feels for a brother being afflicted with this dreaded disease; and we earnestly hope that the interest displayed will continue until this subject is thoroughly and scientifically thrashed out by competent authorities.

The letters from which this article was compiled have been turned over to the National Tuberculosis Association. An advance proof of the article has been sent to most of principal Sunday newspapers throughout the country, and we hope they will take some notice of this phase of the lime industry. Meantime every producer of lime and limestone can help matters by writing to one or more of the advisory council on industrial research of the N. T. A., whose names and addresses are printed at the end of the article referred to.

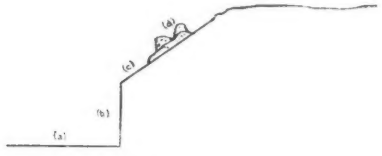
Accident Prevention

Falling Rock Causes Fatal Quarry Accident

By Oliver Bowles, Mineral Technologist, Bureau of Mines

IN A PREVIOUS report of the Bureau of Mines (Serial No. 2086) reference was made to a fatal accident from falling rock in a quarry in Utah, and ways of avoiding such accidents were pointed out. A somewhat similar accident recently occurred in a Maryland limestone quarry. As operators of stone quarries welcome suggestions as to safer quarry practice, a brief outline of this accident may be of advantage to them.

This quarry is a circular pit 500 to 600



Quarry conditions at time of fatal accident

ft. across and 80 to 100 ft. deep. The rock is a dense limestone with the beds dipping at 35 to 45 deg. from the horizontal. Numerous erosion cavities, filled with red sand and clay, are confined largely to the upper 20 or 30 ft. of the deposit. Open bedding planes are 4 to 10 ft. apart toward the surface, and are spaced at wider intervals toward the quarry base. The open bedding planes present smooth, uniform rock surfaces that dip steeply into the pit at the northeast side of the quarry opening. These smooth surfaces are dangerous as they may permit loose material to slide into the pit.

In this instance a blast had thrown down a mass of rock for steam-shovel loading. For two days three men were employed in cleaning down the loose material. A mass of red sand and clay, in which several large boulders were embedded was left on one of these slanting surfaces, the lower edge of which was about 25 ft. above the quarry floor. The quarry conditions are shown in the illustration where (a) represents the quarry floor, (b) the vertical quarry wall, (c) the slanting joint plane surface, and (d) the rock and earth resting on the surface.

After the steam shovel had been loading rock in this part of the quarry for several days a heavy shower of rain fell, and it appears that the water washed away some of the supporting soil from the base of the larger rock msas. Loading was resumed when the shower was over, but shortly thereafter a four-ton boulder rolled over the edge without any warning, killing one man; several others had narrow escapes.

Steeply inclined open bedding planes, not of uncommon occurrence, demand careful quarry practice. They are present in one slate region in Northern Maryland, and while no serious accidents are recorded, great rock slides have resulted. While large masses of rock may slide down on such smooth faces, the greatest danger is from loose material remaining on or above the inclined surfaces. The accident described cannot be attributed to negligence or carelessness, but rather to mistaken judgment. This accident, however, emphasizes the necessity for extreme care in cleaning down all loose material from steep faces.

Statistics show that falls or slides of rock or overburden are one of the principal causes of accidents in quarries (Quarry Accidents in U. S. in 1920, Tech. Paper 295, Bureau of Mines). Operations at the quarry face should therefore receive the most careful supervision, every effort should be made to keep the walls in safe condition, and no improper quarry practices should be permitted.

How Many

Of These Liabilities Do YOU Carry On YOUR Books and How Much Do They Cost You Annually?

DO you know that the cost of a single serious accident is greater than your membership in the National Safety Council would amount to for a period of fifty years? That the National Safety Council's educational service can help you to reduce these and all other accidents by 75 per cent? That all bulletins, pamphlets, booklets, in fact the Council's entire service is prepared out of the combined and accumulative experience of almost 4,000 of the most progressive industrial concerns of America?

IN other words, every bulletin portraying an accident is worked up from the actual experience of some concern. The Council has not only the experience of this one concern to draw from, but of every other concern in its membership engaged in the same line, and of all of those engaged in lines having similar hazards.

THE cost of membership is small—the advantages many. Write the Business Division for details of membership.

National Safety Council

Co-operative Non-Commercial

168 North Michigan Avenue, Chicago, Ill.

Two Plants Without Accidents for Six Months

TWO plants of the Lehigh Portland Cement Co., at West Copley, Pa., and Iola, Kan., have not had a single time-lost accident since June 1. The result from all the Lehigh plants was a 68 per cent reduction in time lost on a man-hour basis as compared with June 1, 1920.

Major Reninger, in charge of the safety and welfare department of the company, has good reason to be proud of the splendid co-operation given him by the men at all his plants. With particular reference to the West Copley and Iola plants he says: "Both safety committees are working continuously, and for the rest of the organization of the company I say that every safety committee is on the job and doing its very best to keep down lost-time accidents. We feel that the results at the end of the year will be very pleasing and considerably better than they were in 1920."

Taking the Census of Safety Workers

WHILE it is known that engineers and contractors have taken great interest in safety work in the past and have accomplished great things in the prevention of accidents, there is nothing to show how many men and women have been responsible for this work in these fields as a whole. The National Safety Council is now taking a census which will reveal this fact. This census will include all persons engaged in safety and industrial health activities in all industries, as well as those doing public safety work. The results will show how the engineering, contracting and building supply fields compare with other industries as to the number of persons engaged in safety and health work.

The census includes not only members and employes of members of the National Safety Council, but all persons engaged in safety and industrial health activities regardless of whether they are connected with the council in any way or not.

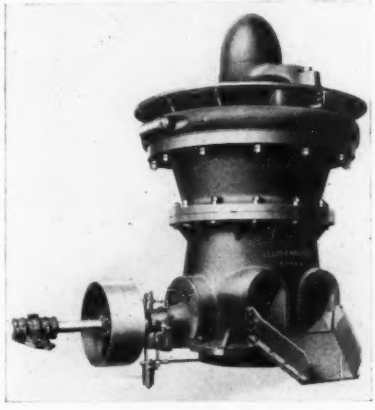
Every reader of ROCK PRODUCTS who is professionally engaged in industrial or public accident prevention or industrial health work—whether devoting all or only part of his time—is urged to assist by sending to the National Safety Council, 168 North Michigan avenue, Chicago, his name, address, organization, the nature of business, other activities, etc., a form for which will be sent upon request by the National Council.

New Machinery and Equipment

Improved Type Gyratory Crusher

AN improved style "N" gyratory crusher of the Gates Iron Works and the Allis-Chalmers Mfg. Co., Milwaukee, Wis., is announced.

This crusher is being developed in sizes ranging from the No. 3, with a 7-in. opening, to a No. 18, with a 36-in. opening. The crusher, according to the manufacturers, retains the advantages of the present form of gyratory crushers in having a shaft of sufficient length and leverage to keep within reasonable limits the total pressure on the eccentric, thereby running



Model "N" Gyratory Crusher

with considerably less friction than the "low-down" or short-frame crushers. It has a shorter and larger diameter shaft than the present gyratory, resulting in more than 50 per cent greater strength.

"A radical departure has been made in the discharge opening of the crusher. In other types of gyratory crushers the lower part of the diaphragm had to be made much steeper on account of the tendency of the stone to lodge in the corner where the shell intersects the diaphragm at the discharge opening. In the standard type crusher this opening was considerably restricted in order not to weaken the shell.

In style "N" this difficulty is overcome by making two openings with a strut between, which is cast integral with the bottom shell, so that the width from outside to outside of the discharge opening is greater than was permissible with the standard designs, at the same time obtaining a stronger construction and freer discharge.

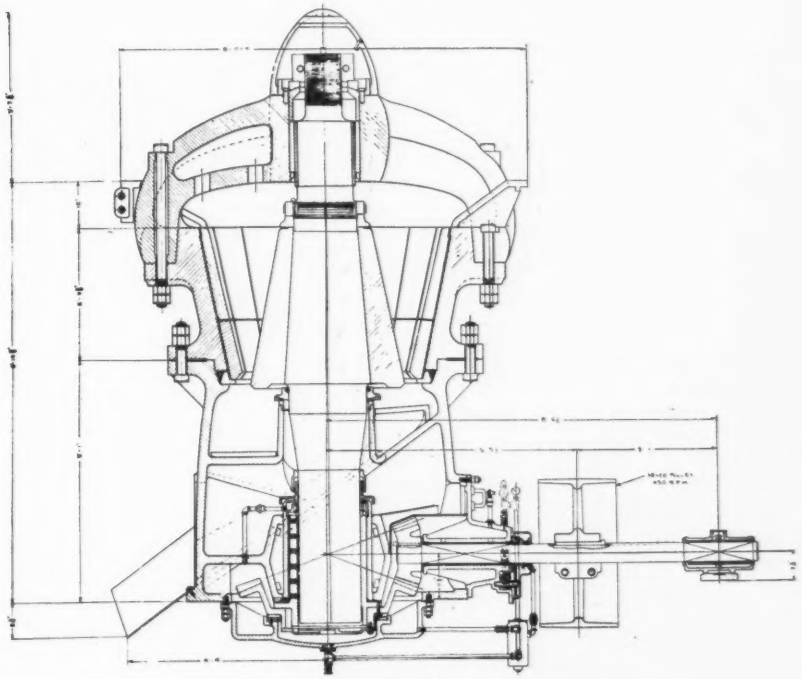
"There are three openings in the bottom shell, one directly opposite the discharge spout and one on each side of it at an angle of 90 deg. Two of these openings have a light cast-iron cover; to the third is bolted the countershaft bearing. The machine, therefore, may be made either regular, right-hand or left-hand drive by locating the bearing in the proper opening.

"The bottom plate of the larger sized crusher is provided with wheels so that it can be easily pulled out for inspection or repairs.

"The oil supply is contained in the outer annular ring of the bottom plate, from which it is drawn through a strainer well direct to the pump mounted in a turned recess in the outer end of the countershaft bearing. The gear-type pump is driven directly by the countershaft through a spur gear and pinion, all of which is enclosed in an accessible dust and oil-proof housing.

"In designing the style 'N' crusher the Allis-Chalmers Mfg. Co. has reduced the installation height 16 per cent of its present gyratory crusher—that is, the distance from the top of the feed hopper to the point of the discharge spout, this distance on all present types or low-down short-frame crushers being approximately the same.

With the crusher there is a complete set of foundation bolts, with nuts and washers; a forged I-bolt for the main shaft top; steel wrenches for the nuts and bolts, and babbitting sleeves for the eccentric. All parts are made to jig and template so that repairs shipped from the factory can be readily installed, and will fit the same as the original parts.



Sectional elevation of Style "N" gyratory crusher

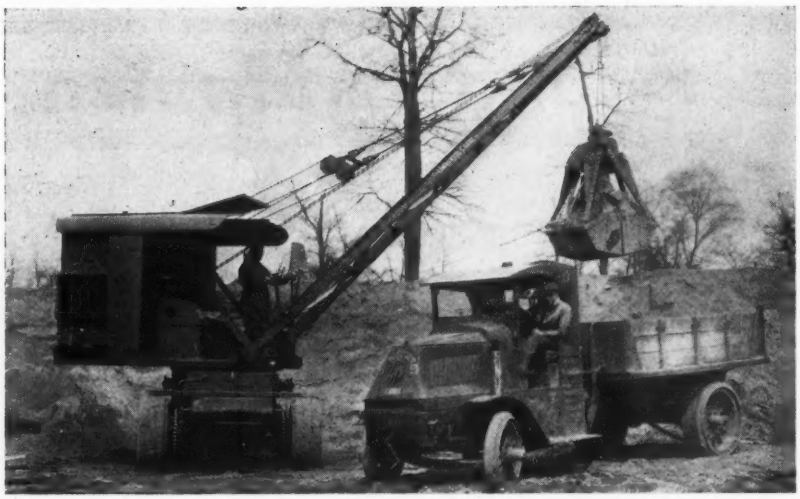
Rubber Belts for Heavy-Duty Service

DURING the past year the Cincinnati Rubber Mfg. Co., Cincinnati, Ohio, has built a 55x260-ft. addition to its plant and increased another part three stories, the addition giving a 200 per cent increased capacity.

The company is producing for the sand and gravel and crushed stone industry the Pacemaker friction surface belt for transmission and heavy-duty service and extra cover conveyor belts, the Hontas, Arno and Pacemaker. This company also makes Sandow sand suction hose and Arno dredge sleeves.

Portable Crane

THE aim of the Universal Crane Co., Cleveland, Ohio, says its announcement, has been to build a crane that could be mounted on anything that would fit it best to the work. It is claimed that this



Universal crane mounted on a motor truck handling sand

full circle swing crane has the functions of the large locomotive crane; that its compact construction and light weight make for higher operating speeds than do heavy locomotive cranes.

The power is either gasoline or electric and only one man is needed for its operation. The Universal crane (shown in the accompanying illustration) handles either a clamshell bucket on a hoist block. The trailer mountings have travel and steering gear, controlled from the operator's stand. The crane weighs, without mounting, about 15,000 lb.; the rear swinging clearance is 7 ft. 6 in. from center of rotation.

Balanced Skip-Hoist Transporter

THERE is now being manufactured by the Exeter Machine Works, 30 Church street, New York, a balanced skip-hoist transporter noteworthy in that the horizontal transportation is combined with the hoisting operation in a single machine. It has recently been patented by Warren Travell of that company. That the skip may carry its load both vertically and horizontally an opening is provided in the upper portion of the front side for receiving the load, with single or double-hinged doors on the opposite side for discharging when the skip runs on a horizontal track. The skip is filled preferably from a hopper chute. The gate controlling the flow is either hand operated or by an automatic filling device. The skip doors or valves are held closed by a latch, discharge being accomplished by tripping the latch. Half of the load and the weight are balanced by a counterweight operating during the vertical motion of the skip. In lowering the empty skip the motor raises the counterweight and performs the same amount of work as in hoisting. A second counterweight takes up the slack rope from the hoisting drum during horizontal travel. At the top of the vertical rise the skip carries with it a bar connected by cable to a third counterweight which pulls the skip backward when discharged. Manual labor is reduced by automatic switches which reverse the motor at both ends of the skip's run. In combination with the automatic filling device the skip hoist is made entirely automatic. It may be of any desirable capacity and the height of lift and length of run of any reasonable distance required.

Semi-Diesel Oil Engine

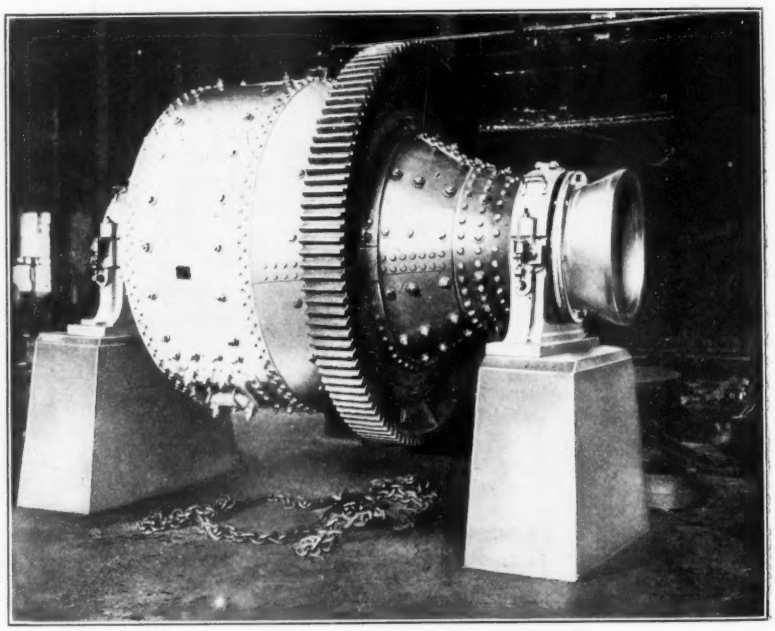
THE distinguishing features of the Anderson type K oil engines, announces the makers, the Anderson Foundry and Machine Co., Anderson, Ind., are that they give steady operation on all loads to full load; that they will burn the cheapest grades of fuel oil with little or no smoke without water being fed into the mixture.

All parts are enclosed to protect them from throwing grease and oil and from dirt and dust; the vertical design saves floor space over the horizontal type; the shifting spray nozzle eliminates air pocketing troubles; the injector pump is of the simple plunger type; all the parts are interchangeable; the engine can be started in one or two minutes.

Anderson engines are tested at 10 per cent overload and the fuel consumption and horse-power rating are based on 1000-ft. level. The auxiliaries, says the company, have been made with the understanding that good engine operation depends upon the proper functioning of the auxiliary equipment.

Conical Mill with Improved Trunnion

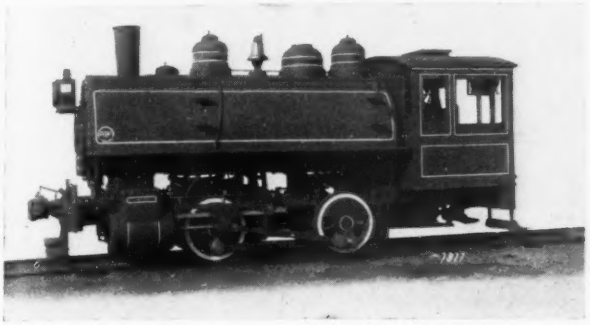
DURING 1921 the Hardinge Co., New York, designed a new mill with large trunnions which the company claims has been highly satisfactory in operation. It is the same in principle as the type formerly made by this company, but is the result of experience in grinding materials by both the wet and dry process. The bearings may be water-cooled when grinding hot clinker; the Titanite lining lasts four or five years; the plate and screw-type feeder has wide ranges of capacity. In fine grinding the mill is operated in conjunction with air separators and with electrically vibrated screens. The illustration shows a Hardinge mill set up on foundations in the shop before shipment.



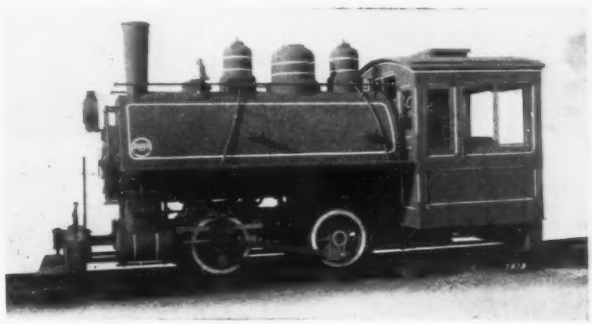
Hardinge mill set up on foundations

Switching and Short-Haul Locomotives

TWO types of four-coupled tank locomotives have been put on the market by the manufacturers, the Baldwin Locomotive Works, Philadelphia, which are suitable for contractors' service and for switching and short-haul work in and about quarries, cement mills and gravel plants.



Light Baldwin four-coupled tank locomotive weighing 37,000 lb.



Heavy Baldwin four-coupled locomotive weighing 77,500 lb.

The lighter locomotive shown in one of the illustrations is of 3-ft. gage and weighs 37,000 lb. It exerts a tractive force of 7440 lb., has a saddle tank of 700 gal. capacity and cab space for 1000 lb. of fuel. The heavier locomotive is of standard gage, weighs 77,000 lb. and has a tractive force of 17,000 lb., with water and fuel capacities respectively of 1300 gal. and 1600 lb.

These locomotives are similar in design and construction and are strongly built for severe service, especially the frames, bumpers and spring rigging. The water tanks are extended over the smokeboxes to gain capacity. The equipment includes steam brakes, with shoes on all wheels, and front and rear sandboxes. The fireboxes are placed over the frames, increasing the grate area and making the staybolts easily accessible. The boilers are of ample size to insure free steaming. The heavy locomotive has M. C. B. couplers. Several locomotives of each type are carried in stock for immediate delivery.

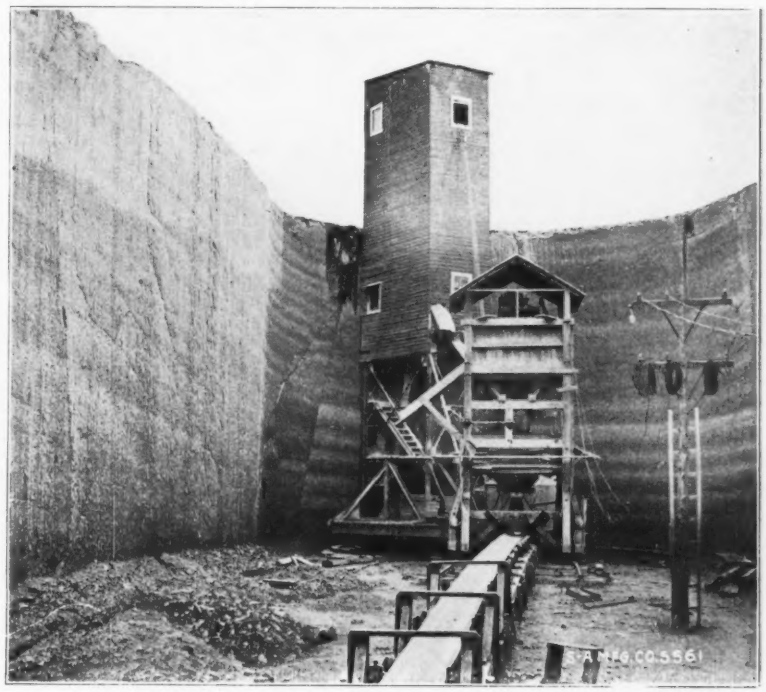
Continuous Planer Type Excavator

FOR excavating clay, shale, chalk rock and other materials of similar nature, the Stephen-Adamson Co., Aurora, Ill., has put on the market continuous planer type of machine known as the "Adel Excavator." This machine is now being used at several portland cement plants for excavating clay and shale. The Gulf States Portland Cement Co., Demopolis, Ala., employs an Adel excavator for stripping chalk used in manufacturing portland cement.

The Adel excavator consists of a heavy bucket elevator, provided with cutters spaced at regular intervals between the elevator buckets. The elevator is carried on a truck and pivoted, permitting oscillation through an arc of approximately 180 deg. The depth of the cut may be adjusted to the height of the bank and to the motion of the elevator in order that the cuttings from one tool completely fill the series of buckets directly following.

Immediately succeeding the completion of a cut through the semi-circle the machine is mechanically advanced for the required depth of the cut, which ranges from 1 to 3 in., according to the material. After each completion of a swing through the 180-deg. arc the machine is advanced, and this cycle of operation continues until it is necessary to advance the pivot truck and to lay additional track. The advancement of the pivot truck is completed mechanically under the machine's own power.

As the elevator is operated the cutters plane the material from the bank, and the particles drop into the buckets and are discharged at the head end of the machine. At this point the material is spouted to a storage hopper from where it is directed into the cars and delivered to the plant or from where a boom conveyor may dispose of the material in one of several different ways.



Adel excavator operating in shale bank. Belt conveyor in foreground

In using the Adel excavator it is essential that the material be hard enough that the bank will stand up without being supported and without the danger of caving. The company cites the advantages of a vertical cut machine, inasmuch as it can be appreciated that the face of the bank

is not greatly affected by the weather. This makes it possible to operate the machine in practically any kind of weather. This fact alone eliminates the necessity of carrying large reserve supplies of raw material on hand to operate the manufacturing plant through a period when other methods of excavation could not be carried on.

These excavators are manufactured to suit requirements and have been furnished for banks where the cutting is from 40 to 60 ft. high and where the radius is from 36 to 54 ft. respectively. The capacity ranges between 50 and 75 tons per hour, depending on the class of material being excavated.

The construction of the Adel excavator is extremely heavy and structural steel members and steel castings have been used where the strains are severe. The machine weighs approximately 60 tons and is operated by a single 50-h.p. electric driving motor with an auxiliary 7½-h.p. motor for moving the machine over the circular track. All the controlling mechanism is conveniently located in an operator's cab and one man has complete control of the action of the excavator. Another man lays the track as the machine advances. When the machine has advanced 4 ft. the pivot truck is progressed and a removable track section placed in front of the pivot truck.

Vibrating Device for Gravitation Screen

ATTENTION is called by the Simplex Screen Co., Salt Lake City, Utah, to the development of a vibrating device, as applied to Simplex Screens. This vibrating device, the company claims, broadens the scope of its screens, thus making possible the handling of fine screening problems as well as coarse screening problems. For fine screenings a screen cloth is used in the screen frame, instead of screening bars.

The mechanical vibrating device is claimed to be very simple, inexpensive both as to cost and maintenance and operates on the back of the screening surface proper. It delivers sharp raps to the back of the screening bars at the rate of 200 per min. The movement of the screening surface is in keeping with the screen opening, both with screen cloth and screening bars, and thus prevents clogging. In a test that the company made, a mixture of clay and sand so damp that practically none went through the screen, was passed over the screen cloth surface and with the vibrating device in motion, it is claimed that not one mesh over the entire screen surface became clogged. The movement of the screen surface worked the material over the screen slowly, and there was no evidence of clogging either while the material was passing over the screen or after it had left the screen.

In the Simplex screen frame, there is said to be no stretching of screen cloth; furthermore, the cloth cannot sag as Simplex screening bars, which are placed in the usual manner in the screen frame forms a backing for the screen cloth and also a medium for receiving the raps from the mechanical vibrating device.

In placing screen cloth in a Simplex screen frame, there are no holes of any kind or cut in the cloth, the edges at the sides are merely bent up, the side plates of the screen removed and the screen cloth put in place. The side plates are bolted to the screen frame and the cloth is held rigidly in a most effective manner. The gravitational principles of the screen has been described in a previous issue of Rock Products.

Simplex screen with screening bars

Cast-Iron Storage Tanks

THE American cast-iron storage tank recently put on the market by the Conveyors Corporation of America, Chicago, is adaptable for all industries where storage of dry materials of a loose, bulky nature are needed, particularly in the rock products field. The claims made are that a cast-iron tank is preferable to tanks of other materials, as it is long-lived, with low-maintenance costs; it will not rust, and is easily and quickly erected by inexperienced workmen.

This cylindrical tank is erected on a 5-in. reinforced concrete slab supported on a structural steel base or tower. The tank body is made up of ½-in. 2x2 ft. radius plates held vertically between cast-iron H-sections. The tank can be built up to any convenient height. The supporting structure can be built to conform to local conditions, with sufficient clearance for trucks, wagons or railroad cars.

Each tank is equipped with two 24x24 in. undercut gates which allow maximum tonnage to be withdrawn. These gates insure clean discharge, as no material will cling to the sides of the cylindrical tank as it would to the corners of a square tank. All side thrust is prevented by a cold-rolled steel angle running around the tank. Structural supports are not necessary.

Gasoline Revolving Shovel

A GASOLINE - OPERATED shovel with no boilers, motors, shafts, chains or gears on the boom and yet with

an actual digging power greater than a steam shovel of the same size is the most recent innovation announced by the Bucyrus Co., South Milwaukee, Wis.

This 30-B gasoline shovel marks a distinct advance in the design of excavating machinery, says the company. For 10 years Bucyrus dragline excavators have been operated by gasoline engines, but the application of this power to the revolving shovel involved more difficult and intricate problems, chiefly efficient power transmission to the thrust without excessive complications in design, and obtaining digging power commensurate with that of a steam machine of similar size. These problems have been solved, and furthermore, the manufacturers have obtained in this new machine the digging characteristics of the steam shovel with its quick reversals, its powerful dipper thrust and its dependability.

Bucyrus shovels in operation at the quarry of the Waukesha Lime and Stone Co., South Milwaukee, Wis.

The Bucyrus transmission design is simple. The thrusting motion on the dipper is accomplished by means of a small drum keyed to the shipper shaft, as is shown in the illustration. On this drum are anchored two ropes, A and B, rope A leading over the top of the drum, through the padlock and over the sheave at the boom point and down to the hoisting drum which runs loose on the shaft. Rope B leads from under the shipper shaft drum over the second sheave on the boom and back to the thrusting drum which also runs loose on the same shaft. Thrusting out is done by a pull on rope A; thrusting in, by a pull on rope B.

Hoisting is accomplished by setting the brake on the thrust drum. Thrusting out may be varied or diminished by manipulating the brake on the thrusting drum. If the brake is partly released, the motion will be thrusting and hoisting; entirely released, all motion is thrusting; if the brake is applied in full, hoisting is the result. Every dipper motion of the steam shovel can be made with this device.

Before being put on the market, this shovel had a six-months' test in overcasting and loading dump cars in sticky clay; grading a concrete road where the cut averaged 5 in. in old macadam, and stripping a stone quarry and loading trucks in a stiff hardpan containing many boulders. Its success has been completely demonstrated by actual test.

The manufacturers claim the following outstanding features for this new shovel: It is simpler than steam, electric or other types of gasoline shovels and has fewer parts to maintain; its digging power is greater than a steam shovel of the same size; it has all the steam shovel's performance characteristics even to shaking the dipper to relieve it of sticky material. This shovel will give 20 per cent greater yardage per gallon of gasoline than an electric shovel of the same size, or than any other type with power derived from a gasoline engine—there is less mechanical losses and waste energy.

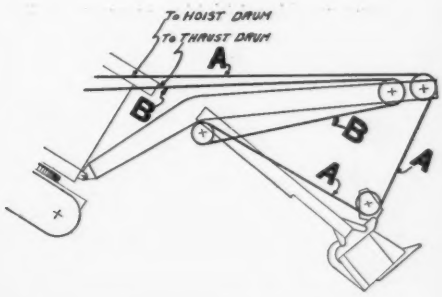
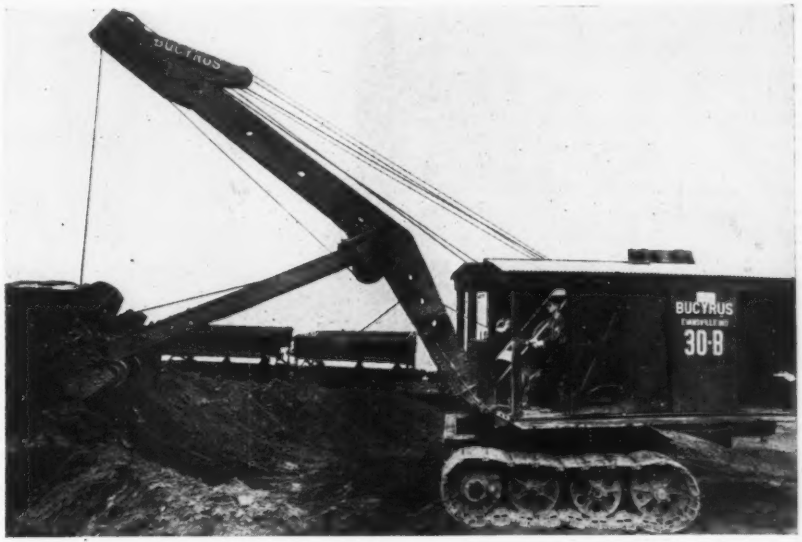


Diagram of transmission of power to thrust

The gasoline engine is more than twice as heavy and rugged as the type sold for this purpose. It was designed by the Bucyrus engineers especially for this shovel and is entirely inclosed—dustproof.



Bucyrus "30-B" shovel loading dump cars

This four-cylinder, slow-speed engine will develop 55 hp. at 400 r.p.m. The shovel carries a 1-yd. dipper. This machine may be equipped as a dragline ex-

cavator, a crane or a clamshell machine with simple changes which may be made in the field.

During a 4¼ hour continuous test made while the shovel was stripping overburden at the quarry of the Waukesha Stone and Lime Co., Waukesha, Wis., the gasoline consumption was at the rate of 10.1 gal. per hour. The material moved was estimated at ¾ cu. yd. per dipper, this being considered highly conservative. The output averaged 44.1 yd. per hour loading trucks with 3 or 4 dippers each, and 71 yd. per hour overcasting. On loading, the shovel averaged 1.7 dippers per minute and 29.3 trucks per hour. The material was hard pan with many stones in a bank from 8 to 12 ft. high.

Another test was in very shallow work in regrading and widening an old tar macadam road where the average width was 16 ft., and the cut ranged from 0 to 5 in. In 2970 min., 2375 ft. of road was graded, or at a rate of 48 ft. per hour. The total gasoline consumption was 230 gal., or 4.65 gal. per hour.

Tested in yellow clay, the shovel dug and loaded 160 cu. yd. in 1 hr. 16½ min., measured from the time the first train was spotted until the last train left. The quantity was estimated at ¾ yd. per dipper; gasoline consumption was 9 gal., which was at the rate of 7.06 gal. per hour., or 17.8 yd. per gal.; the work averaged 1.9 dippers per min.

Small-Type Blast-Hole Drill

TO MEET the demand for a blast-hole drill handling tools of medium weight, drilling 4 to 5-in. holes, the Sanderson-Cyclone Drill Co., Orrville, Ohio, has placed on the market the No. 14 Junior blast-hole drill—a counterpart of the company's Fourteen Standard in design, but constructed on a smaller scale.

The spudding device lifts the tools with a slow, steady motion and gives a quick drop; the geared hoist transmits the engine power directly to the drum; only one clutch is needed; worm and gear feed slacks off the cable; all levers are so designed that the driller need not move away from the drill; the main castings are of cast steel. The machine works equally well when fitted with steam, gasoline, electric or with compressed air power. Heavy timbers are used for the frame, the frame being braced and tied.

Valve Bag Packing Machine

A VALVE bag packing machine has been put on the market by the Modern Valve Bag Co., East Orange, N. J., which it is claimed will save from 2 to 4 per cent of the total shipments. This machine is said to ensure uniform weight, a recent test showing an average of 95 lb. The capacity, without belt or chute delivery, is 500 bbl. per man in 10 hr., exclusive of tying. It is of simple construction and noiseless, requires but 12 hp. and can be either direct or belt driven.

As seen in the illustration, the valve is in the neck of the bag, thus throwing the weight on the folded cloth and supporting it by the wire tie. The advantages claimed for the valve type of bag are: The bag is easily filled, the capacity is not reduced by folded corners, no breaking of valve on the machine or in transit; no leakage; placing the valve at the top of the bag prevents caking.

Bag-packing machine

Gas-Tight Protector from Dust and Fumes

FOR protection against poisonous and irritating dust and other mixtures, the Pulmoran Safety Equipment Co., 45 Willoughby street, Brooklyn, N. Y., has put on the market the Pulmoran gastight protector made as a mask or helmet, to suit requirements. No pressure blower is needed to operate it nor does it require any assistants, says the company. It enables one man to quickly penetrate fume-laden localities, effect emergency repairs, do rescue work, etc.; has no chemicals or gages.

The face piece is attached to the operator's face, the hose resting in the fresh air which is drawn through a funnel; can be operated up to 300 ft. of hose. The hose is non-kinkable, the web belt adjustable and gastight goggles and a fibre carrying case is provided.

Low-Velocity Air Separator

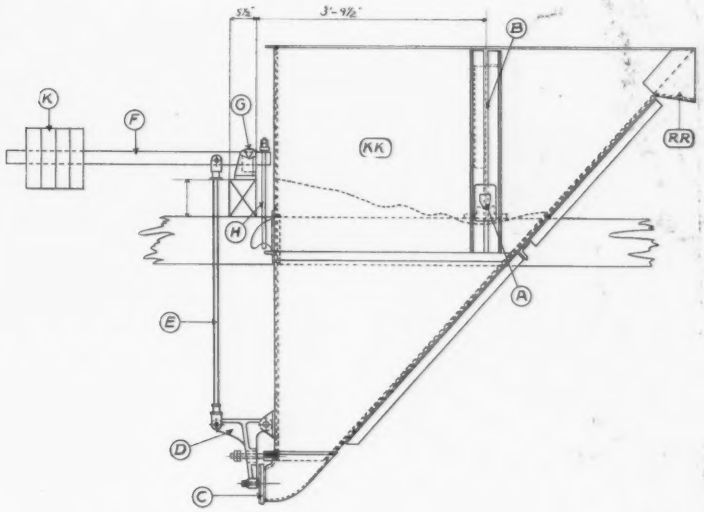
SEVERAL minor improvements have been made in the Gayco-Emerick separator, announces the Rubert M. Gay Co., 114 Liberty street, New York, making the machine more accessible and easily

adjustable and its efficiency raised to the point where all the products will pass 200 and 300 mesh screens.

This low-velocity separator can handle abrasive materials, particularly quartz, spar, silica, etc. It will also remove dust from concentrates, slate granules and similar materials.

A small-size machine has been put on the market that will be useful in laboratories and plants requiring small capacities of extremely fine material. It is accessible and easily adjustable for products of from 80 mesh to 300 and finer, handling nearly all dry materials irrespective of their weight.

Gayco-Emerick low-velocity air separator



Details of sand-settling tank

Balanced Sand-Settling Tank

A BALANCED sand-settling tank for sand and gravel-washing plants has recently been designed by the Smith Engineering Works, Milwaukee, Wis.

This triangular tank, with a hopper bottom, is swung on supports and has a discharge valve opened by a lever with an adjustable counterweight. It is claimed that knife-edged bearings for both the tank and counterweight make this device sensitive and subject to close adjustment. In discharging there is a double movement; the tank tips with the weight of the sand, the bottom moving to the right. At the same time the lever opens the gate by a movement to the left, so that with ¼-in. gate travel there is ½-in. gate opening.

Referring to the illustration, the tank is supported on two knife-edge bearings, *A*, and is adjusted by counterweight *K*, the counterweight arm being supported on knife-bearing *G* and connected to the tank by U-bolt *H*. The valve *C* is operated from the counterweight arm by the connecting rod *E* and the bell crank *D*.

The sand-laden water is introduced in compartment *KK*, and it flows under the baffle plate *B* the sand deposits, while the dirty water flows out of the spillway *RR*. The sand accumulates until it tips the tank away from the valve plate, this movement tending to pull up the counterweight arm, which lifts the bell crank and operates the valve; thus the tank and valve swing in opposite directions. The short, rapid movement permits the discharge of only a small quantity of material at one time.

Tool Steel Gears for Heavy-Duty Service

IN introducing its gears to the rock products industry the Tool Steel Gear and Pinion Co., Cincinnati, Ohio, announced that where ordinary tool steel gears, either cast or cut tooth, are used, there is rapid wear or breakage troubles. This company's tool steel gear, it says, will outlast by from five to eight times the ordinary products, keeping the machinery in constant operation and saving not only on gearing costs but on loss in production while the gears are being changed. These gears are said to have very strong centers and are hardened on the wearing surface so that they take on a high polish and resist wear for a long time.

Volume vs. Weight in Powder

EXPLOSIVES, claims the Hercules Powder Co., Wilmington, Del., must be judged in two ways—by weight strength and by bulk strength. In many cases, says the company, where 40 per cent and lower strengths of dynamite are now being used in rock blasting, Special No. 1 will effect an appreciable saving—in quarries, railway and highway excavations, etc. Hercomite, however, is more economical than Special No. 1 when blasting in the softer materials such as shales and clays, gypsum mining and other purposes. Cartridge for cartridge, its execution will approximate that of 25 per cent Extra dynamite, while its cost is less than 15 per cent.

Many concerns apparently think that "powder is powder," failing to analyze dynamite from the standpoint of both volume and weight strengths. The company stands ready to advise users of explosives as to what best suits their needs.

Sand Classifier

FOR regulating the percentage of different-sized particles in sand, the Dorr Co., New York City, announces the Dorr classifier. This classifier is an inclined shallow tank to which water is fed in such proportions that properly graded sand will overflow at one end. Reciprocating rakes continuously remove all over-size particles from the tank. This classifier eliminates the use of screens and mechanically turns out a product well within the specifications.

Power-Swiveling Loader

THE Link-Belt Co., Chicago, Ill., announces that it has placed on the market a new portable loader that is capable of digging and loading all sorts of bulk material. The machine requires but one operator.

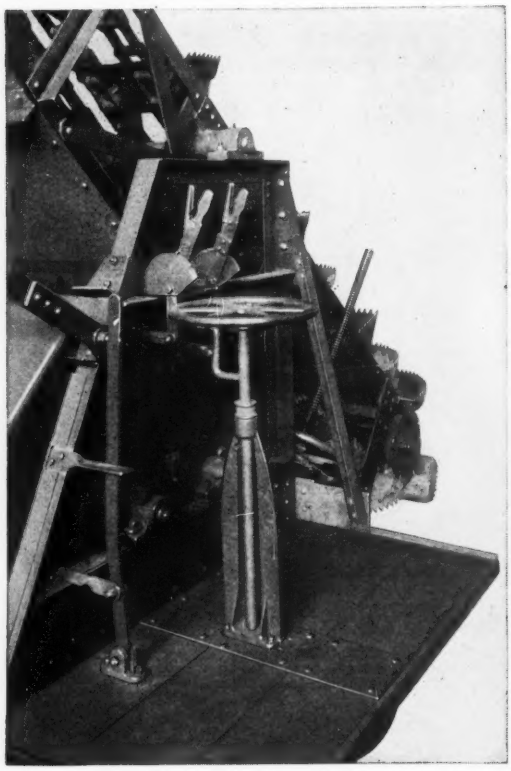
The elevating medium of the loader is arranged to swivel in a horizontal plane. This feature, coupled with a self-propelling mechanism, produces a unit which clears a path wide enough for the loader to move into piles of material.

The operator directs the digging end of the elevator in an arc, the maximum width of which is over 20 ft. When cutting reaches the end of each arc, the loader is advanced a short distance automatically towards the pile, thus making a wide cut in the pile, as far as required. Provision is made to prevent damage to machine in case of buckets striking a hidden obstruction.

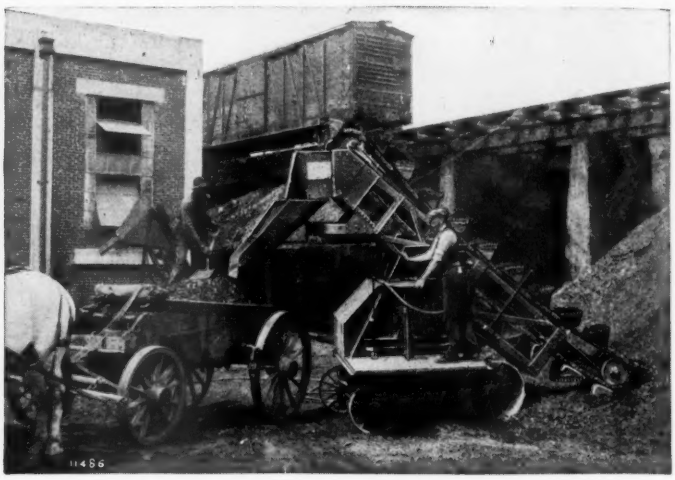
It is not necessary to drag or scrape the material into the path of the buckets. The digging buckets are carried on a chain, the whole operating on the principle of taking the buckets to the material. The buckets on the loader are provided with digging edges; the top of every other bucket is an arc, and the alternate bucket is rectangle. This feature permits of the bucket digging with a fresh surface, cutting with a portion of its edge only, and eliminating the heavy drag and shock to machinery occasioned by the entire bucket surface digging into the pile.

The operator stands on a platform which swivels with the elevator, permitting the operator to have the digging and discharge point in view at all times. All controls are in easy reach. The operator, being elevated above the ground and away from the moving parts, is free to center his efforts toward loading the greatest amount of material without giving thought to personal safety.

The power swiveling loader has a capacity for handling 45 cu. ft. per min. of loose materials, and a speed of 5 or 75 loose materials, and a speed of 5 or 75 ft. per min., forward or backward, at will of operator, can be collapsed to overall height of 9 ft. 8 in. for passing obstruction, or storing in building and is operated by 7½ h.p. motor, or 15 to 20 h.p. heavy duty gasoline engine.



Control arrangement on loader



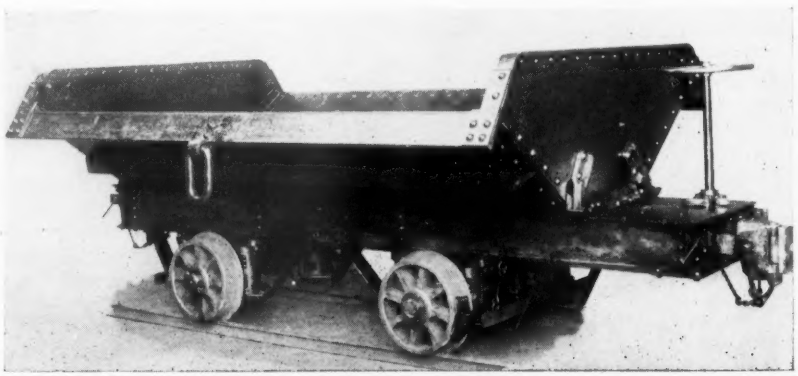
Loading from ground storage into wagon

Crushed Stone and Gravel Dump Car

A NEW type of quarry car has been placed on the market by the Atlas Car and Mfg. Co., Cleveland, Ohio. This type has the hopper resting on a structural bed, with pivoted projections on the ends extending downward. Flanges extending upward engage the projections and prevent any endwise movement of the frame. The body is swung upward when dumping its load.

On each side of the hopper there are rings to engage the air or electric hoist. When tilting the hopper the hoisting mechanism is connected to links on the side opposite to which the hopper is dumped. When the hopper is in dumping position the pivots engage the flange and stop the hopper from tilting beyond the desired point; on the release of the hoisting mechanism the hopper will of its own weight assume its normal position.

These cars are built in capacities of from 3 to 15 tons, with or without brakes, and up to standard track gage. The accompanying view shows a dump car equipped with chain brakes.



Atlas stone or gravel dump car

Industrial Gasoline Locomotive

THE Cummings Machine Co., Minster, Ohio, has recently placed on the market its new Model F six-ton gasoline industrial locomotive (see illustration) on which several improvements and special features are claimed.

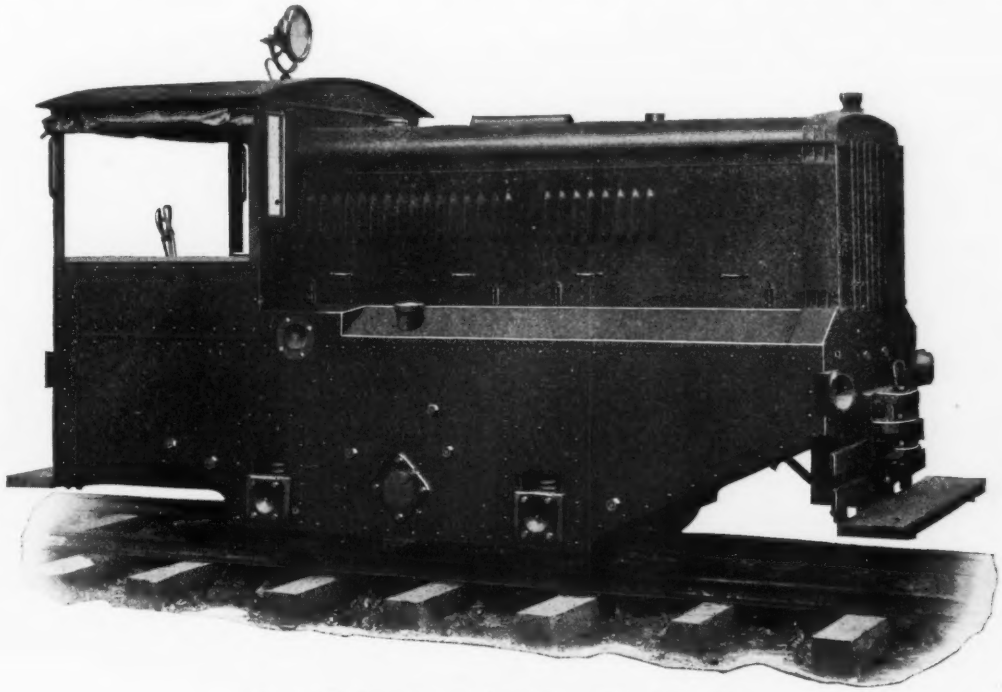
Among these improvements are the removal of the engine hood doors, making it possible for the operator to make his adjustments quickly and conveniently. He is fully protected from inclement weather and his vision is unobstructed from all sides. The cab is "roomy," having a height from floor to roof of 5 ft. 5 in. The seat occupies the entire width of the cab; the tool box is under the hinged seat; all electrical instruments are mounted on a removable panel; the coupler is readily removable, allowing the height to be changed to meet any condition; the searchlight can be changed to throw light behind the locomotive. Both hood and cab are separate units and can be demounted from the frame by removing a few bolts, and they will not distort when remounted.

This locomotive is of all-steel box girder construction, in crane, bridge and wherever it is necessary to provide against the excessive strains and stresses to which the industrial locomotive is subjected.

The wheels are Carnegie rolled steel, with M. C. B. flanges, giving 25 per cent greater tractive effort than will cast-iron chilled wheels. The brake wheel, on the jackshaft between the double sprocket and the jackshaft bearing, is of large diameter and wide face.

The Buda engine in the Cummings locomotive is designed to meet the exacting demands of all kinds of operation, giving continuous, dependable service.

All Cummings locomotives are thoroughly tested before shipment. Model F weighs six tons, has a dawbar pull of 2400 lb. at four miles per hour, and a speed up to 10 miles per hour, with a length overall of 159 in.



Model F Cummings industrial gasoline locomotive

The Motor Truck in Rock Excavation

CONFRONTED with the problem of excavating and hauling nearly 750,000 cu. yd. of material blasted from solid limestone, the Read-Coddington Engineering Co., contractors for the Niagara Falls Power Co., Buffalo, N. Y., which

Noon hour at the 750,000 cu. yd. excavation for the power-plant extension of the Niagara Falls Power Co. Fleet of 20 fire-ton trucks. The grade at extreme right is 20 per cent

has under way an $8,500,000 power extension, decided to utilize a fleet of 20 five-ton Pierce-Arrow motor trucks equipped with 4-yd. dump bodies, and new horizontal type of power hoist, mounted beneath the steel body, thereby giving more load room, since the body can be brought close to the cab.

To brace the body against the shock of loading, four 35-lb. steel rails were fastened to the bed of the bodies.

At the speed with which the trucks operated, the steam shovel served as high as 12 trucks, although at times only 10 were used. The haul is two miles. Each truck makes from 11 to 13 trips a day, an average of 135 or 140 loads daily. About 2-yd. are loaded each time.

Operation soon revealed several practical features which speeded up the truck work. For instance, tail gates on the body were dispensed with, as a full load could be carried by piling it at the forward end, thus no time being lost in fastening or unfastening the tail-gate locks. Moreover there is no danger of the steam shovel operator damaging the tail gates with the dipper.

Another economy is the method used in constructing the incline. To climb out of the pit the trucks, in low gear, ascend a short ramp with a 20 per cent grade. For a short distance there is a 12 per cent climb leveling out for 30 ft. into a grade of only a few per cent. This gives the driver opportunity to shift from low to second gear preparatory to the final 250-ft. climb of 10 per cent—in other words, a "gear-shift level" enables the trucks to gain headway sufficient to make a faster ascent with a smaller expenditure of fuel. Thus, a fleet average of 4.5 miles per gal. of gasoline is maintained.

The contractors have found it impossible to avoid a certain amount of abuse to which the trucks are subjected. For instance, in loading a five-ton boulder the steam shovel will drop it as gently as possible on the rear of the truck, and then the shovel will "bunt" it ahead. This operation shakes the truck as if it were a boy's cart. Although the pit surface is kept as smooth as possible, it frequently is strewn with rock and debris. Sometimes a truck will back over a rock the size of a barrel, dropping off with a severe jar, or a loaded truck will jounce over a heap of rough stones. Breakage was expected, but at the end of 10,000 miles of operation these trucks had escaped the repair shop 90 per cent of the time; in fact, most of the repairing done was necessitated through accidental collisions. To keep the trucks in adjustment and to facilitate emergency repairs, a chief mechanic and assistants are employed. Close attention is given to lubrictaion, it being the sole duty of one man to grease and oil the chassis.

Difficulties encountered by the trucks working on the inlet excavation equal those which have made the outlet so severe a testing ground. At the inlet the work is being done behind a coffer-dam which locks out the river. About 100,000 cu. yd. of loose material are being removed.

Four or five trucks are employed on the shafts which will pierce the tunnel, worked in double shifts most of the time. From the two shafts about 3000 cu. yd. of material are to be removed, being hoisted in a bucket which drops a full load into a truck.

All the tunnel material will be hoisted through the shafts except that which is blasted from the tunnel intake and outlet. The intake and outlet are bell-shaped, narrowing from 50 to 36 ft. excavation measurements. The actual diameter of the tunnel when lined will be 32 ft. About 350,000 loose yards will be removed.

When the company had given 15 of these Pierce-Arrow trucks a six months' test, five more trucks were purchased and put in operation.

Gasoline-Electric Revolving Shovel

TO meet the demand for a gasoline and electric steam shovel from certain localities, the Marion Steam Shovel Co., Marion, Ohio, has recently placed on the market its new Model 21 revolving shovel. This shovel is particularly adapted to those localities where coal costs are high and fuel unsatisfactory, and where boiler feedwater is scarce or unfit for use, thus making steam shovel operation unsatisfactory.

The company announces that in the development of this shovel experimental features were eliminated, frictions and brakes were dispensed with and the controlling apparatus perfected in every way, so as to make the shovel satisfactory for electric and gasoline power.

In this new shovel the hoisting, rotating and crowding motions each function through separate motors and the general principle of control and operation is identical to the steam machines. With this idea of construction, many parts that are used on the steam machine are retained on the electric and gasoline outfits—in fact, with the exception of the power units, the various parts of any model are interchangeable.

A direct connected generating set is installed at the rear of the upper frame of the gasoline-electric shovel. It consists of a four cylinder, vertical, heavy duty gasoline engine fitted with Bosch magneto, Stromberg carburetor and water pump and engine shaft extended for connection to the direct current generator. The engine has an S. A. E. rating of 53 hp. On the all electric machine this gasoline engine is replaced with an electrical motor; otherwise the construction of the machines are identical. The generating set is mounted on a heavy cast iron base.

The company claims that these new machines are just as flexible as steam and will handle just as hard material at the same speed as the steam machine. Because of the special construction of the generator a peculiar voltage characteristic is generated, thereby assisting in obtaining extreme flexibility.

The motors are of the totally enclosed type. Each motor is mounted on a rigid base and is so located that it will not interfere with the use of the standard drums, bearings and shafts. This new design is even carried to the extent that the motors and generating set can be disposed with and the machine converted into a standard steam outfit, in case such a change should ever be desired.

At the front of the upper frame, on the side opposite to the levers, is located the motor driven direct connected air compressor which furnishes air for the hoisting ram and self-locking crowding brake. This compressor is automatic, requiring no attention except occasional lubrication.

Non-Freezing Gelatine Explosives

ALL DuPont Gelatine and Straight explosives are made on the low-freezing formula and will not freeze under usual temperature conditions in this country, says the manufacturers, E. I. Du Pont de Nemours & Co., Wilmington, Del. These explosives are supplied in sizes ranging from ⅞ to 5 in. in diameter.

Durox, a special ammonia explosive of the bulk type running from 155 1¼x8 in. cartridges to the 50-lb. case, is especially recommended for use in limestone quarries, where the stratification is flat and the stone is not too massive.

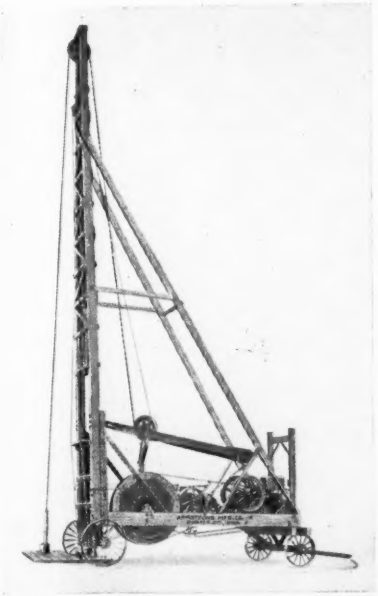
Where a number of deep holes are fired simultaneously, and it is desirable to break the charge, the Du Pont Co. advises the use of Cordeau-Bickford fuse in well drill blasting.

Starter for Squirrel-Cage Motor

AMONG its recent developments the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has announced the Cutler-Hammer auto-transformer or compensator type of starter for squirrel-cage motors. This starter, says the company, is simple, compact, all parts are accessible and the wearing parts can be replaced at small cost. The new relay has eliminated the use of fuses and attendant unnecessary delays and provides for good starting torque and momentary overloads.

Big Blast Hole Drill Derrick

A RECENT development in big blast hole drilling machinery of importance to quarry operators is the Armstrong patent wire line derrick on well drills, put on the market by the Armstrong Manufacturing Co., Waterloo, Iowa. This derrick, says the company, makes it possible to use steel cable in



Non-traction blast-hole drill equipped with patent wire line derrick

place of manila cable on blast hole drills, eliminating the troubles encountered when steel cable is used exclusively.

Owing to the character of the work the cable must run over the sheaves in the same place day after day and when using manila rope it burns out quickly, thus adding materially to the cost of drilling. Steel cable should not be used for drilling without a shock-absorbing device to protect the machine from the shock and vibration caused by the motion of the tools while in operation.

The Armstrong patent wire line derrick provides a wide range of elasticity through a continuous length of hawser laid manila cable built into the derrick; it never runs over a sheave or in the drill hole; it is subjected to no external friction, and provides the proper amount of spring in drilling line regardless of depth of hole, weight or tools.

Used with steel cable this derrick not only adds to the drilling efficiency of the machine by running on a faster drilling motion and longer strokes, but it represents a saving in cable costs.

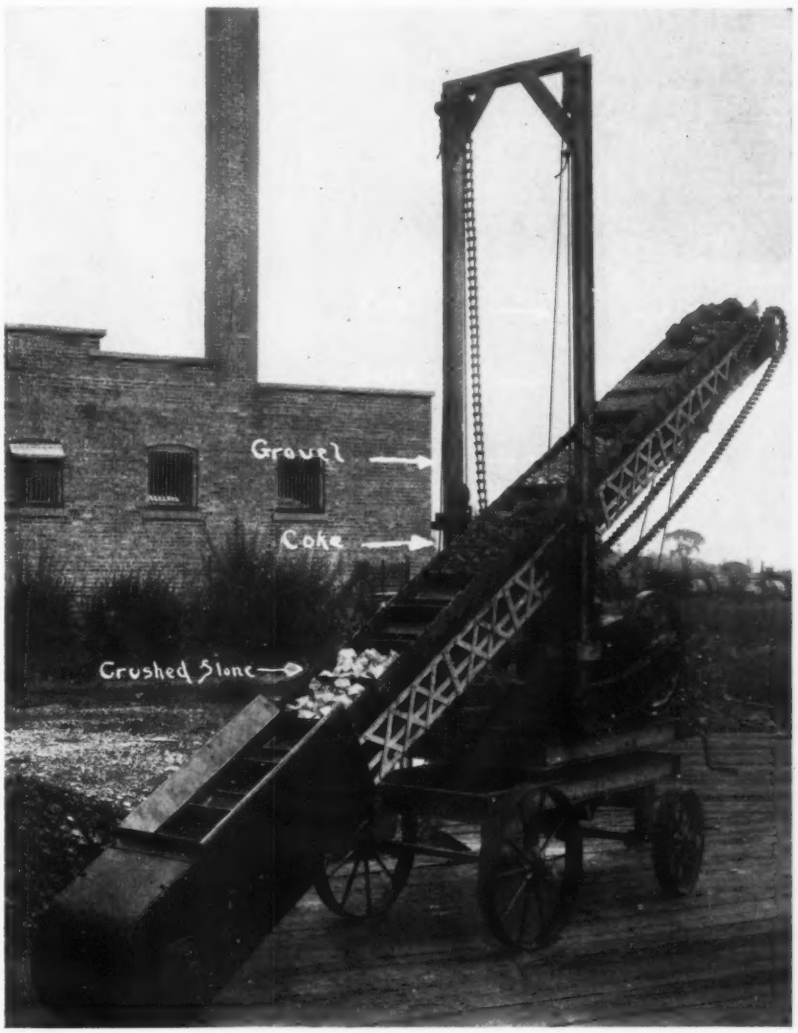
The illustration shows the construction and operating features of this derrick. The derrick is now furnished as regular equipment with all Armstrong blast hole drills leaving the factory, and can also be attached to Armstrong drills in operation in quarries where it is desired to change from manila to wire line.

Portable Overlapping Steel Bucket Conveyor

FOR handling crushed stone, gravel, sand, etc., the McKinney-Harrington Co., North Chicago, announces its All-U-Need conveyor. With only 5 ft. between the car side and the bin, says the company, the machine can be pushed in, the conveyor swung around and good capacity be had even if the elevation is 45 degs.

The conveyor is built 17, 20 and 24 ft. in size—delivering 12, 15 and 17 ft. high; is 14 in. wide and 5 in. deep, and built of No. 18 gage steel stayed and braced by flat and angle steel parts. Gasoline or electric motors can be used. A 3-hp. motor or engine will furnish sufficient power to handle one ton a minute if the elevator is kept full. This machine can be equipped either portable or stationary for loading from car to bin or from car to open pile. It is mounted on four steel wheels 24 in. in front and 30 in. in rear, with 3x⅜-in. grooved tires.

This elevator has a sub-floor, the lower end of which for about 4 ft. is No. 14 gage sheet steel, the balance No. 18. This floor is held in place by two hard-wood ribs along the edges on which the chain travels; the ribs are bolted in place and easily removed. The conveying chains are of two strands of riveted pintle No. 485, to which are attached upright steel flights with attachment links about 13-in. centers. The conveyor can be folded for transportation or storage.



Portable overlapping steel bucket conveyor

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.00	1.00	1.00	1.00	.....
Buffalo, N. Y.	1.50	per net ton all sizes—Winter prices from stock				
Burlington, Vt.	1.00	.....	2.50	2.00	2.00	.....
Chaumont, N. Y.	.....	.....	1.75	1.25	1.25	1.25
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	.....
Coldwater, N. Y.	1.50 per net ton, all sizes					
Eastern Penna.	.75	1.60	1.60	1.60	1.60	1.60
Munns, N. Y.	.70	1.15	1.15	1.15	1.15	1.15
Western New York	.70	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alden, Ia.	.80@1.00	.80@1.00	1.50	1.45	.....	.....
Alton, Ill.	2.00	.....	1.50	1.35	1.35	.....
Bettendorf, Ia.	All sizes, 2.00 cu. yd. f.o.b. quarry					
Buffalo, Iowa	1.00	1.50	1.40	1.30	1.35	1.35
Chicago, Ill.	1.20	1.60	1.20	1.20	1.20	1.20
Dundas, Ont.	.85	1.35	1.35	1.35	1.25	1.10
Greencastle, Ind.	1.25	1.10	1.00	1.00	1.00	1.00
Illinois, Southern	1.75	1.60	1.50	1.50	1.40	.....
Kokomo, Ind.	1.10	1.25	1.25	1.10	1.10	1.10
Krause or Columbia, Ill.	1.40	1.25	1.25	1.10	1.10	1.10
Lannon, Wis.	.90	1.00	1.00	1.00	1.00	1.00
Marblehead and Brillion, Wis.	1.10	.....	1.20	1.10	1.10	.....
Montrose, Ia.	1.35@1.50	1.60	1.50@1.60	1.60	1.50	1.50
River Rouge, Mich.	1.00	1.15	1.15	1.15	1.15	1.00
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Southern Illinois	1.50	1.40	1.40	1.35	1.35	.....
Stolle, Ill. (I. C. R. R.)	1.55	1.55	1.55	1.30@1.35	1.50	1.50
Stone City, Iowa	.75	.....	1.40	1.35	1.30	.....
Toledo, Ohio	1.84	1.99	1.99	1.99	1.84	1.84
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
Valmeyer, Ill.	1.60	1.30	1.30	1.30	1.30	1.30
Waukesha, Wis.	all sizes 1.10 per ton					
SOUTHERN:	These prices include 90c freight					
Cartersville, Ga.	.....	2.00	.....	1.45	1.45	.....
Chickamauga, Tenn.	1.00	.80	.80	.80	.70	.65
Dallas, Texas	1.10	1.25	1.25	1.25	1.10	1.10
Ft. Springs, W. Va.	1.20	1.50	1.75	1.60	1.45	1.30
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	.....
Gainesville, Ga.	1.00	1.25	1.25	1.25	1.25	1.25
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	.....
Ladds, Ga.	2.00	2.00	2.00	1.50	1.50	1.50
Morris Spur (near Dallas) Tex.	1.10	1.25	1.25	1.25	1.25	1.25
Portland, Ga.	.60@1.00		(All other sizes 1.00@1.25)			
Shephard, Tenn.	1.00@1.25	1.00@1.25	1.00@1.25	.75@1.00	.75@1.00	.....
WESTERN:						
Atchison, Kans.	.50	2.10 (Rip-rap.	2.10	2.10 1.80 per ton)	2.10	2.10
Blue Springs and Wymore, Neb.	.20	1.65	1.65	1.55	1.45	1.40
Bromide, Okla.	.60	1.50	1.50	1.50	1.30	1.30
Cape Girardeau, Mo.	1.50	.....	1.50	1.50	1.25	.....
Kansas City, Mo.	1.00	1.80	1.80	1.80	1.80	1.80

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Baltimore, Md.	1.25	2.50	2.35	2.25	2.00@2.25	2.00
Bernardsville, N. J.	2.00	2.20	2.00	1.80	1.50	.....
Branford, Conn.	.60	1.50	1.25	1.15	1.10	.....
Bound Brook, N. J.	2.00	2.30	2.00	1.70	1.60	.....
Dresser Jct., Wis.	1.25	2.25	2.25	1.75	1.50	.....
Duluth, Minn.	.90@1.00	2.25	1.90@2.00	1.50	1.25@1.50	1.40
Dwight Station, Calif.	.75@1.00—all sizes					
E. Summit, N. J.	2.10	2.35	2.15	1.75	1.75	.....
Eastern Mass.	.60	1.95	1.75	1.50	1.50	1.50
Eastern New York	1.00	1.80	1.70	1.50	1.50	1.50
Eastern Penna.	1.25	1.80	1.70	1.60	1.50	1.50
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60@ .80	1.60@1.75	1.50	1.25	1.10	.....
Oakland, Calif.	1.75	1.75	1.75	1.50	1.50	1.50
Richmond, Calif.	.50*	.....	1.75*	1.50*	1.50*	.....
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Springfield, N. J.	2.00	2.10	2.00	1.75	1.75	1.75
Westfield, Mass.	.60	1.35	1.30	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Alexandria Bay, N. Y.	1.60	.....	1.30	1.50	1.20	.....
Columbia, S. C.—Granite	.75	.....	2.75	2.50	2.35	.....
Dell Rapids, S. D.—Granite	.75	1.85	1.75	1.70	1.70	.....
Dundas, Ont.—Flint	1.00	1.50	1.50	1.50	1.25	1.20
Eastern Penna.—Sandstone	1.00	1.75	1.75	1.50	1.50	1.50
Eastern Penna.—Quartzite	.90	1.60	1.40	1.30	1.30	1.30
Holton, Ga.—Granite	.40	.....	2.50	2.25	2.25	2.00
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30	.....	1.20	.....
Los Angeles, Cal.—Granite	.....	1.25@1.50	1.15@1.40	1.15@1.40	.....	.....
Macon, Ga.—Granite	.50	.....	2.50	2.25	2.00	1.25@1.90
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.25@2.80	.....	1.25@1.50
Red Granite, Wis.	1.35	1.40	1.30	1.50	1.20	.....
Sioux Falls, S. D.—Granite	.75	1.85	1.75	1.70	1.70	.....
Stockbridge, Ga.—Granite	.50	2 00	1.90	1.75	1.75	.....
Utley, Wis.—Red Granite	1.35	1.40	1.30	.....	1.20	.....

*Cubic yard. †Agrl. lime. ||R. R. ballast. §Flux. ‡Rip-rap. a 3-inch and less.

Agricultural Limestone

EASTERN:

Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.00; bulk 2.50

Coldwater, N. Y.—Analysis, 56.77% $CaCO_3$, 41.74% $MgCO_3$, 70% thru 200 mesh, 95% thru 50 mesh, sacks 4.00; bulk 3.00

Grove City, Pa. — Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$—100% thru 20 mesh, 60% thru 100 mesh, 40% thru 200 mesh; in 80 lb. paper sacks, 4.50; bulk 3.00

Hillsville, Pa.—70% thru 100 mesh; sacks, 4.75; bulk 3.00

Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$, 5.25% $MgCO_3$; sacks, 4.50; bulk 2.75

New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk 3.00

Texas, Md.—Analysis, 58.02% $CaCO_3$, 37.3% $MgCO_3$—50% thru 50 mesh; bags, 4.25; bulk 2.50

Waltord, Pa. — 50% thru 100 mesh, 60% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk 3.00

West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 5.00—cloth, 5.25; bulk.. 3.50

Williamsport, Pa. — Analysis, 88-90% $CaCO_3$, 3-4% $MgCO_3$—50% thru 50 mesh; paper, 5.00; bulk 3.75

CENTRAL:

Alton, Ill. — Analysis, 96% $CaCO_3$, 0.3% $MgCO_3$—90% thru 100 mesh.... 7.75

Bedford, Ind. — Analysis, 98.5% $CaCO_3$, .5% $MgCO_3$—90% thru 10 mesh ..... 1.60@2.00

Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk 2.50

Bettendorf, Ia.—Analysis, 97.16% $CaCO_3$, 1.9% $MgCO_3$—50% thru 100 mesh, 1.50; 50% thru 4 mesh..... 1.50

Buffalo, Ia.—90% thru 4 mesh..... 1.00

Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.3% $MgCO_3$ (90% thru 50 mesh, 2.00), 50% thru 4 mesh..... 1.50

Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$—90% thru 4 mesh.... 1.00

Columbia, Ill., near East St. Louis—½-in. down ..... 1.25@1.80

Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh..... 1.80@3.80

Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$—50% thru 50 mesh 1.25

Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh..... 2.00

Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh..... 1.40

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$—90% thru 50 mesh..... 2.00

Marblehead, O.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$—52.4% thru 100 mesh, 59% thru 50 mesh, 100% thru 4 mesh; sacks, 4.75; bulk..... 3.00

Limestone screenings; bulk..... 1.50

McCook, Ill.—Analysis, 54.10% $CaCO_3$, 45.04% $MgCO_3$—100% thru ¼-in. sieve, 78.12% thru No. 10, 53.29% thru No. 20, 38.14% thru No. 30, 34.86% thru No. 50, 22% thru 100 ..... 1.50

Milltown, Ind. — Analysis, 93.10% $CaCO_3$, 3.2% $MgCO_3$—33.2% thru 100 mesh, 40% thru 100 mesh..... 1.25@1.65

Mitchell, Ind.—50% thru 100 mesh..... 2.00

Montrose, Ia.—90% thru 100 mesh..... 1.35

Narlo, Ohio—Analysis 56% $CaCO_3$, 43% $MgCO_3$, limestone screenings, 37% thru 100 mesh; 55% thru 50 mesh; 100% thru 4 mesh..... 1.50@2.00

Ohio (different points), 20% thru 100 mesh; bulk ..... 1.25@1.50

Piqua, O. — Analysis, 82.8% $CaCO_3$, 8.2% $MgCO_3$; neutralizing power in terms of calcium carbonate, 95.3%—80% thru 100 mesh..... 3.25@5.00

50% thru 50 mesh..... 2.00

River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk..... .80@1.40

Stolle, Ill., near East St. Louis on I. C. R. R. — Thru ½-in. mesh — Analysis, 89.61% to 89.91% $CaCO_3$, 3.82% $MgCO_3$ 1.75

Stone City, Ia.—Analysis, 98% $CaCO_3$ 50% thru 100 mesh..... .75

(Continued on next page)

Agricultural Limestone

(Continued from preceding page.)

Toledo, Ohio—¼-in. to dust, 20% thru 100 mesh	1.50
Waukesha, Wis.—No. 1 kiln dried	2.00
No. 2 Natural	1.75
Yellow Springs, Ohio—Aanlysis 96.08% $CaCO_3$, 63% $MgCO_3$, 32% thru 100 mesh; 95.57%, sacked, 6.00; bulk	4.25
SOUTHERN:	
Barber, Va.—Analysis, 92 to 98% $CaCO_3$—Bags, 6.50; bulk	4.50
Blowers, Fla.—Analysis, 98% combined carbonates—75% thru 200 mesh	4.75
Cape Girardeau, Mo. — Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$ — 50% thru 100 mesh	2.00
90% thru 4 mesh	1.50
Cartersville, Ga.—Analysis, all thru 10 mesh	2.00@2.50
Claremont, Va. (Marlime) — Analysis, 90% $CaCO_3$, 2% $MgCO_3$—(90% thru 100 mesh, $4.00), 50% thru 100 mesh	3.50
Dittlinger, Tex. — Analysis, 99.09% $CaCO_3$, .04% $MgCO_3$—90% thru 100 mesh	2.00@3.00
90% thru 4 mesh	1.00@2.00
Ft. Springs, W. Va.—50% thru 100 mesh	3.00
Grevania, Ga.—Analysis, 95% $CaCO_3$, no $MgCO_3$—50% thru 100 mesh	2.50
Knoxville, Tenn.—Pulverized	2.50
90% thru 100 mesh	2.00
90% thru 50 mesh	1.50
Ladds, Ga.—90% thru 50 mesh	2.00
Linnville Falls, N. C.—Analysis,, 53% $CaCO_3$; 42% $MgCO_3$—50% thru 100 mesh; sacks, 4.50; bulk	3.00
Mascot, Tenn.—Analysis 52% $CaCO_3$, 38% $MgCO_3$—80% thru 100 mesh	3.00
All thru 10 mesh	2.50
80% thru 200 mesh	4.50
Paper bags, $1.50 extra per ton; burlap, $1.00 extra per ton.	
Maxwell, Va.	2.50
Ocala, Fla. — Analysis, 98% $CaCO_3$—75% thru 200 mesh	4.50
WESTERN:	
Colton, Calif.—Analysis, 90.95% $CaCO_3$, 2-3% $MgCO_3$—all thru 14 mesh—bulk Sacks, 15c extra, returnable.	4.00
Garnett, Okla.—Analysis, 86% $CaCO_3$, 50% thru 4 mesh	.50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk	1.80
Terminous, Calif. — Analysis, 97.3% $CaCO_3$, .04% $MgCO_3$—65% thru 200 mesh, 90% thru 100 mesh, 95% thru 80 mesh, 100% thru 50 mesh; sacks, 5.00; bulk	4.50
Tulsa, Okla.—90% thru 4 mesh	.50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:	
Baltimore, Md.	2.25@2.75
Berkley Springs, W. Va.	2.00@2.25
Cedarville and South Vineland, N. J.—Damp, 1.75; dry	2.25
Cheshire, Mass.	5.00@7.00
Hancock, Md.—Damp	2.50@3.50
Klondike and Pacific, Mo.	2.00@2.50
Mapleton, Pa.—Dry	2.50
Damp	2.00
Massillon, Ohio	3.00
Millington, Ill.	1.75
Mineral Ridge, Ohio	2.50@3.00
Montoursville, Pa.—Green, washed	1.40@1.75
Oregon, Ill.—Large contracts	1.75
Ottawa, Ill.	1.25@1.50
Pittsburgh, Pa.—Dry, 4.00; damp	3.00
Rockwood, Mich.	3.00@3.50
Round Top, Md.—(washed-screened)	1.25
St. Mary's, Pa.—Unwashed	2.25
Thayers, Pa.—Washed	2.00@2.50
Utica, Ill.	1.25@1.75
Zanesville, Ohio	2.50
FOUNDRY SAND:	
Albany, N. Y.—Sand blast	4.00
Molding fine, coarse and brass	2.00@2.10
Allentown, Pa.—Core and molding fine	1.50@1.75
Arenzville, Ill.—Molding fine	1.40@1.60
Beach City, O. — Core, washed and screened	2.00@2.50
Furnace lining	2.50@3.00
Molding fine and coarse	2.25@2.50
Bowmantown, Pa.—Core	1.35@1.50
Molding, coarse	1.80@2.00
Cleveland, O.—Molding coarse	1.50@2.00
Brass molding	1.50@2.00
Molding fine	1.50@2.25
Core	1.25@1.50
Columbus, O.—Core	.30@1.25
Sand blast	4.50@5.00
Furnace Lining	2.00
Molding fine	2.00@2.75
Molding coarse	1.75@2.50
Stone sawing	1.50
Traction	1.00
Brass molding	2.75

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge and So. Heights, Pa.		1.30	1.30	1.30	.85	.85
Attica, N. Y.	.75	.75	.75	1.00	1.00	1.00
Buffalo, N. Y.	1.10	.95	.85		.85	
Erie, Pa.		1.00		1.15		1.25
Farmingdale, N. J.		1.00				
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.		.50	1.75	1.50	1.35	1.25
Ludlow, Mass.	.75•	.75•	1.70		1.50•	1.50•
Philadelphia, Pa.	.75	.75		1.40	1.25	
Pittsburgh, Pa.		1.30	1.30	1.30	.85	.85
Portland, Maine		.50	1.75		1.35	1.35
Texas, Md.		1.00		Pure white sand, 1.50		
Washington, D. C.	.75	.75	2.00	1.40	2.00	2.00
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.50				.90
Attica and Covington, Ind.	.90	.90	.90	1.00	1.00	1.00
Barton, Wis.		.60	.70	.70	.70	.70
Beloit, Wis.		.50			.50	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, Ohio	.70	.65	.90	.90	.90	.90
Columbus, Ohio	.80@1.00	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	100@1.25
Des Moines, Ia.		.40@ .65	1.60	1.60	1.60	1.60
Detroit, Mich.	.65	.65	.95	.95	.95	.95
Earlestead (Flint), Mich.	.70		60-40 sieves, .85; Pebbles, .95			
Eau Claire, Wis.	.40		1.25		.90	
Elgin, Ill.		.80	1.00	.80	.80	.80
Elkhart Lake, Wis.	.70	.58	.90	.90	.72	.72
Ft. Dodge, Ia.		1.22		2.17		
Grand Rapids, Mich.		.45		.85		.75
Greenville, Mechanicsburg, O.	.60	.50	.50	.50	.60	.60
Hawarden, Ia.		.50			1.60	
Hersey, Mich.		.50		.70	.70	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Le Mars. and Doon, Ia.		.90		1.80		
Libertyville, Ill.		.70		.70	.70	
Mankato, Minn.	.50	.50	.75@1.50	.75@1.50	.75@1.50	.75@1.50
Mason City, Ia.	.90	.80	1.90	1.80	1.70	1.65
Milwaukee, Wis.	1.15	1.15	1.25	1.25	1.25	1.25
Minneapolis, Minn.	.50	.50	1.50	1.35	1.25	1.25
Moline, Ill.	.80	.80	1.40	1.40	1.40	1.40
Riton, Wis.		.40			.50	.50
St. Louis, Mo., f. o. b. cars	1.20	1.52½	1.67½	1.47½		1.42½
St. Louis, Mo., delivered on job	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.75		.85	.75	.85
Waukesha, Wis.	.60		All other sizes, .70 per ton			
Winona, Minn.	.60	.50	1.75	1.50	1.25	1.25
SOUTHERN:						
Alexandria, La.	.60@ .80	.50@ .75			.85@1.50	1.20@1.50
Birmingham, Ala.	1.48		all gravel—1.88			
Charleston, W. Va.			(Sand, 1.40@1.50; gravel, 1.50			
Estelle Springs, Tenn.	1.15	1.10			1.00	.85
Ft. Worth, Tex.		2.00		2.00		2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	1.00@1.15	1.00@1.15		2.12	1.92	1.74
Lake Weir, Fla.		.75				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.12	1.12				1.95
N. Martinsville, W. Va.	1.10	1.10		1.30		.90
New Orleans, La.		.50			1.00	
Pine Bluff, Ark.	.90@1.25	1.00@1.20	Washed gravel, all sizes, 1.75			
Roseland, La.	.25		1.00	1.00		
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.	(Kaw River sand, car lots, .75 per ton, Missouri River, .85)					
Niles, Calif.	1.00	1.00	1.40	1.00	1.00	1.00
Pueblo, Colo.	1.10•	1.00•			1.50•	
San Diego, Calif.	.80@1.00	.80@1.00	1.30@1.60	1.25@1.55	1.15@1.45	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.50•	1.50•	2.00•	1.50•		1.50•

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
Attica, Covington, Silverwood, Ind., and Palestine, Ill.	.75	.75	.75	.75	.75	.75
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, 1.00 per yd.			
Cherokee, Ia.			.80 per ton—1.20 washed			
Detroit, Mich.	1.10•					
Dudley, Ky. (Crushed Sand)		1.05		1.00		
East Hartford, Conn.			.65 per cu. yd.			
Elkhart Lake, Wis.			Washed gravel .66			
Estelle Springs, Tenn.						.85
Fishers, N. Y.	.60@ .65			.60		.50
Glenville, N. Y.				1.00•		
Hamilton, O.			.45 per cu. yd. in pit			
Hartford, Conn.		1.00•				
Hersey, Mich.				.50	.50	
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Janesville, Wis.		.65		.65@ .75		
Lindsay, Tex.		1.95				.60
Oxford, Mich.				.65	.65	
Pine Bluff, Ark.			Road gravel .60			
Rochester, N. Y.	.60@ .75	.60@ .75			.50@ .65	.50@ .65
Roseland, La.		.75				
Saginaw, Mich., f. o. b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			60% gravel, 40% sand, 1.50			
Summit Grove, Ind.	.60	.60	.60	.60	.60	.60
Waco, Texas		.80		1.50		1.30
Winona, Minn.			.70	.70	.70	.70
Yardville, N. J.		.50@ .75				
York, Pa.		1.10@1.20		(crushed rock sand)		

•Cubic yard. B Bank. L Lake. ‖ Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.10	2.50	1.35	1.25	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Easton, Pa.	2.00	.90	1.50	1.00	1.00	1.00	1.00
Erie, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Emporium, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Lebanon, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Sharpsville and West Middlesex, Pa.	2.00	1.30	.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, $1.50, F. O. B. Chicago						
Detroit, Mich.	All sizes, 1.65, F. O. B. Detroit						
Ironton, O.	2.05	1.75	Other grades 1.75				
Jackson, O.	2.00	1.35	1.70	1.35	1.35	1.35	1.35
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	2.93	2.30	2.49	2.49	2.49	2.30	2.30
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
Steubenville, Lowellville and Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.00@1.25	1.15	1.05@1.10	.85@1.00	.85@ .90
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton & Low Moor, Va.	2.50	1.00	1.60	1.25	1.25	1.15	1.05

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing Hydrate	Masons' Hydrate	Agricultural Hydrate	Chemical Hydrate	Ground Burnt Lime Blk.	Ground Burnt Lime Bags	Lump Lime Blk.	Lump Lime Bbl.
EASTERN:								
Adams, Mass.			7.00					3.50
Bellefonte, Pa.			11.50		8.00			
Berkley, R. I.			14.00					2.50
Buffalo, N. Y.		11.00	11.00	11.00			9.50	2.00•
Chaumont, N. Y.					2.50	4.00		
Paxtang and Le Moyne, Pa.					5.00		5.00@7.50	
Rockland, Maine						8.00		
Union Bridge, Md.			13.00		5.50			
West Rutland, Vt.	13.50	12.25	7.50@12.25	14.00			11.00	3.50
West Stockbridge, Mass.			15.00					
Williams and Blue Bell, Pa.			11.25					
Williamsport, Pa.			10.00			10.00	6.00	
York, Pa. (dealers' prices)		9.50	9.50	9.50 (mfrs.)			7.50	
CENTRAL:								
Delaware, Ohio	10.50	8.50	7.50	10.00	7.50		7.50	1.60
Geneo, Ohio	10.50§							
Gibsonburg, Ohio	10.50§	8.50	8.50		6.75	8.75		
Huntington, Ind.	10.50	9.00	8.50				8.00	1.70•
Knowles and Valders, Wis.			12.50		5.00	9.00		
Marblehead, Ohio	10.50	8.50		11.00	6.75		8.00	1.70*
Mitchell, Ind.		12.00	12.00	12.00	10.00			
Sheboygan, Wis.					5.50	8.50		
White Rock, Ohio	10.50				6.75	8.75		
Woodville, O. (dlrs.' price)	10.50a	8.00a	8.00a	8.50a	7.50	8.00	8.00	1.70
SOUTHERN:								
El Paso, Tex.							12.50	
Knoxville, Tenn.	11.00	9.50	9.50				7.50	1.30
Ocala & Zuber, Fla.			13.00		1.50	7.00		
Sherwood, Tenn.	11.00	9.50	9.50	9.50	2.50		7.50	1.30
Staunton, Va.					8.00		9.50b	1.60
WESTERN:								
Colton, Calif.			15.00				19.70	
Kirtland, N. Mex.					12.00		12.50	2.00c
Los Angeles, Calif.			15.00‡				16.00	
San Francisco, Calif.	20.00@25.00		16.00@18.00		16.00	22.00	16.00	2.15*
Tehachapi, Calif.						15.00	20.30	2.00

‡100-lb. sacks; *180-lb. net, price per barrel; †180-lb. net, non-returnable metal barrel; §Paper sacks. (a) 50-lb. paper bags; terms, 30 days net; 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice. (b) Burlap bags. (c) 200-lb. bbl.

Miscellaneous Sands

(Continued from preceding page)

Conneaut, O.—Molding fine	2.25@2.50
Molding coarse	2.00@2.25
Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass Molding	2.15
Dresden, O.—Molding coarse	1.50@1.75
Brass molding	1.75
Dunbar, Pa.—Traction, damp	2.75
Dundee, O.—Glass, core, sand blast, traction	2.50
Molding fine, brass molding (plus 75c for winter loading)	2.00
Molding coarse (plus 75c for winter loading)	1.75
Falls Creek, Pa.—Glass sand	2.50
Furnace lining, traction and molding coarse and fine, and core	2.00
Sand blast	3.50
Eau Claire, Wis.—Core	.75@1.25
Sand blast	3.25@4.25
Traction sand	.50
Franklin, Pa., and Utica, Pa.—Traction	2.00
Brass molding	2.50
Core	1.00@2.00
Molding fine	2.50
Molding coarse	2.25
Sand blast	4.50
Greenville, Ill.—Molding coarse	1.40@1.60
Howard, Ohio — Core, furnace lining, molding fine, stone sawing, traction, brass molding	2.00
Roofing sand	2.50
Sand blast	4.00
Glass sand	2.50@3.00
Joliet, Ill.—Milled, dried and screened No. 2 coarse molding sand and open hearth loam and looting clay	.90@1.25
Kansas City, Mo.—Missouri River core	.80
Kasota, Minn. — Molding coarse and fine, stone sawing (pit run)	1.75
Klondike and Gray Summit, Mo.—Molding fine and core	1.75@2.00
Glass sand	2.00@2.50
Mapleton, Pa.—Core, furnace lining, molding coarse and brass molding	2.00@2.75
Molding fine	2.25@2.75
Roofing sand	2.00@3.00
Sand blast	1.50@2.00
Glass sand	2.25@2.50
Massillon, O.—Traction, molding fine and coarse, core, and furnace lining	2.50
Glass sand	3.00
Michigan City, Ind.—Core, glass, traction and brass molding	.30@ .40
Mineral Ridge, Ohio — Core, furnace lining, molding fine and coarse, roofing, sand blast, stone sawing and traction (green)	2.00
Montoursville Pa.—Core	1.25@1.50
Traction	1.00@1.25
Brass molding	1.40
New Lexington, O.—Molding fine	2.75
Molding coarse	2.50
Oregon, Ill.—Core, glass sand	1.25@1.75
Furnace lining	1.50@1.75
Molding coarse	1.25@1.75
Sand blast and stone sawing	3.00@3.50

Miscellaneous Sands

(Continued)

Ottawa, Ill. — Furnace lining, steel molding, core, roofing sand	1.50
Sand blast	3.50
Ottawa, Minn.—Core	1.00@1.50
Glass, molding coarse, stone sawing (all crude silica)	1.00@1.50
Pelzer, S. C.—Glass sand (carload lots only)	.70
Ridgeway, Pa.—Glass sand, green	2.25
Glass sand, wash	2.50
Molding, fine and coarse	1.20
Rockwood, Mich.—Core, damp	2.50
Roofing	3.00
Sand blast	3.50@3.75
Round Top, Md.—Glass sand	1.75@2.00
Core, furnace lining	1.45
Traction	1.60
(All per 2000 lbs.)	
San Francisco, Cal.—Glass and roofing	3.00@3.50
Core, molding fine and brass	2.30@2.60
Furnace lining and molding coarse	3.60@4.25
Coarse core sand	3.60@4.25
Sand blast	2.30@3.60
Stone sawing and traction	2.30
Thayer, Pa.—Traction	2.00
Furnace lining	1.00
Molding fine and coarse	1.00
Core—green	1.75@2.00
Utica, Ill.—Core, furnace lining, stone sawing	1.00@1.25
Molding fine and coarse	.85
Utica, Pa.—Core	1.25@2.25
Molding fine and coarse, traction, brass molding	2.00
Warwick, O. — Core, furnace lining, molding fine and coarse (damp, 1.75) dry	2.00
Traction, brass molding (dry)	2.00
Williamstown Junction, N. J.—Glass sand	2.80@2.90
Core, wet	2.50@2.60
Zanesville, Ohio — Molding fine and coarse, brass molding	2.00@2.25

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Baltimore, Md.—Crude Talc	3.00
Cubes	50.00
Blanks, per lb.	.07
Chatsworth, Ga.—Crude talc	8.00@10.00
Ground talc (150-200 mesh), bags	12.50
Pencils and steel workers' crayons, per gross	1.50@ 2.00
Chester, Vt. — Ground talc (150-200 mesh)	8.00@10.00
(In Kraft paper bags. $1.00 per ton less in burlap bags, plus 15c for each bag.)	
Emeryville, N. Y.—150-200 mesh; bags	14.00
Glendale, Calif. — Ground talc (150-200-mesh	16.00@30.00
(Bags extra)	
Ground Talc (50-300 mesh)	13.50@15.50
Gouverneur, N. Y.—Ground talc (150-200 mesh)	13.50@14.50
Henry, Va.—Crude talc (lump mine run), per 2000-lb. ton	2.75@3.50
Ground talc (20-50 mesh), bags, 7.00; (200-300 mesh) bags	8.25@11.00
Johnson, Vt.—Ground talc (20-50 mesh), bulk	8.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@15.00
(Bags extra)	
Los Angeles, Calif—Ground talc (150-200 mesh)	18.00@40.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	8.00@10.00
Ground talc (150-200 mesh); bags	9.00@16.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	8.50
(Bags $1.00 extra)	
Ground talc (150-200 mesh), bulk	10.00@15.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75%	6.00@8.50
B.P.L. 65%	6.00
Gordonsburg, Tenn.—B.P.L. 68%@72%	5.00@6.00
Mt. Pleasant, Tenn—Analysis, .70 B.P.L. (2000 lbs.)	7.50
Montpelier, Idaho—70% B.P.L.—Crude	5.00
Crushed 2-in. ring and dried	6.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f.o.b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$ 9.30	$8.40	$8.10	$7.80
24x14	9.30	8.40	8.10	7.80
22x12	10.80	8.70	8.40	9.10
22x11	10.80	8.70	8.40	9.10
20x12	10.80	8.70	8.40	9.10
20x10	11.70	9.00	8.70	8.40
18x10	11.70	9.00	8.70	8.40
18x 9	11.70	9.00	8.70	8.40
16x10	11.70	8.40	8.40	8.10
16x 9	11.70	8.40	8.40	8.10
16x 8	11.70	8.40	8.40	8.10
18x12	11.10	8.70	8.40	8.10
16x12	11.10	8.70	8.40	8.10
14x10	11.10	8.40	8.10	7.80
14x 8	11.10	8.40	8.10	7.80
14x7 to 12x6	9.60	8.40	8.10	.....
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$7.50	$7.20	$5.75
22x11	8.40	7.80	7.50	5.75
Other sizes	8.70	8.10	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.
Granulated slate per net ton f. o. b. quarries, Vermont and New York, 7.50

(Continued from preceding page)

Ground Rock

Paris, Idaho.—2,000 lb. mine run, B.P.L. 70%	4.00
Wales, Tenn.—B.P.L. 70%	7.50
Per 2000-lb. Ton	
Barton, Fla. — Analysis, 50% to 60% B.P.L.	5.00@6.00
Centerville, Tenn. — B.P.L. 60% to 65%	6.00@6.50
B.P.L. 75% (brown rock)	12.00
Columbia, Tenn.—B.P.L. 68% to 72%	5.50
B.P.L. 65% (90% thru 200 mesh) bulk	5.50
Morreston, Fla.—Analysis 60% B.P.L.	12.00
Mt. Pleasant, Tenn.—B.P.L. 65@70%	5.00@6.50
Norwills, Fla.—(Fla. Hard Rock)—B.P.L. 68%	10.00

Florida Soft Phosphate

Raw Land Pebble

	Per Ton
Bartow and Norwills, Fla.—B.P.L. 50%, bulk	6.00@ 8.00
B.P.L. 78%, bulk	13.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

	Per Ton
Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Lakeland, Fla.—B.P.L. 60%	6.00
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65-70% B.P.L.	6.00@ 7.00

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	18.00@20.00	10.00@14.00
Ingomar, Ohio	12.00@22.00	35.00
Lincoln, Neb. — Red, white, grey, in bags		30.00
Middlebrook, Mo.—Red granite; sacks	30.00@32.50	20.00@25.00
Milwaukee, Wis.	21.00@30.00	21.00@27.50
Missouri river points — Different colors	20.00@25.00	20.00@25.00
Piqua, O.—Marble	8.00@10.00	7.00@ 9.00
Poultney, Vt. — Roofing granules		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.—White marble	7.00@12.00	12.00
Crushed white stone and marble dust in 100 lb. bags	6.50@12.00	.....
Tate, Ga.—White limestone, sacks extra	5.00@ 7.00	5.00@ 7.00
Wausau, Wis.	14.00@18.00	.....
Wisconsin and S. Dak. points—Granite, different colors, bulk or sacks	1.50@ 2.00	3.00@ 7.00

Concrete Brick

Prices given per 1,000 brick, f. o. b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	18.00	26.00@34.00
Bellow Falls, Vt.	18.00	25.00
Birmingham, Ala.	16.00	27.50@50.00
Bridgeport, Conn.	31.00	32.00
Carpenterville, N. J.	15.50	40.00@65.00
Easton, Pa.	16.00	40.00@60.00
Eugene, Ore.	25.00@27.00	35.00@75.00
Rochester, N. Y.	21.00	.....
Friesland, Wis.	25.00	.....
Houston, Tex.	.....	19.50
Lockport, N. Y.	17.00	.....
Milwaukee, Wis.	12.50	26.00@40.00
Omaha, Nebr.	16.00@20.00	30.00@40.00
Piqua, O.	15.00	25.00@50.00
Phoenix, Ariz.	16.00	35.00@80.00
Portland, Ore.	23.75	45.00@75.00
Rapid City, S. D.	20.00	30.00@60.00
St. Paul, Minn.	15.00	30.00@35.00
Puyallup, Wash.	22.00	40.00@80.00
Salem, Ore.	25.00@30.00	50.00@75.00
Salt Lake City, Utah	20.00	35.00@55.00
Seattle, Wash.	(select) 20.00	50.00@90.00
Springfield, Ill.	18.00	20.00@25.00
Tampa, Fla.	15.00	25.00@65.00
Walkersville, Ont.	30.00	36.00
Wauwatosa, Wis.	13.00@14.50	26.00@45.00
Winnipeg, Man., Can.	19.00	40.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	7.00
Barton, Wis.	9.00
Boston, Mass.	11.50@12.50
Brighton, N. Y.	14.25
Buffalo, N. Y.	16.50
El Paso, Texas	12.00
Gary, Ind.	11.50@12.00
Grand Rapids, Mich.	12.00
Michigan City, Ind.	10.00
Milwaukee, Wis. (delivered at job)	13.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.	15.00@25.00
Redfield, Mass.	15.00
Saginaw, Mich.	11.50
San Antonio Texas—Common	14.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	18.00
F. o. b. cars	13.00@14.00
Washington, D. C.	13.50
Winnipeg, Can.	14.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Common
Atlanta, Ga.	19.00	16.00
Baltimore, Md.	15.00	13.00
Boston, Mass.	23.00	20.00
Cincinnati, Ohio	19.60	14.50
Chicago, Ill.	18.00	.....
Dallas, Tex.	25.00	.....
Denver, Colo.	30.00	.....
Detroit, Mich.	15.25	13.25
Fort Dodge, Ia.	19.70	17.00
Genoa, Ohio	10.50	.....
Grand Rapids, Mich.	15.65	.....
Gypsum, Ohio	13.90	.....
Los Angeles, Calif.	30.00	30.00
Minneapolis, Minn.	29.00	22.00
Montreal, Que.	21.00	21.00
New Orleans, La.	.....	17.25
New York, N. Y.	16.99	.....
Plasterco, Va.	19.80	.....
St. Louis, Mo.	23.20	20.00
San Francisco, Calif.	22.00	18.00
Seattle, Wash.	27.00	.....
	Lump per 180-lb. Barrel (net) Finishing	Common
Atlanta, Ga.	2.00	1.50
Baltimore, Md.	.....	12.00†
Boston, Mass.	3.35	3.10
Cincinnati, Ohio	.....	12.25
Chicago, Ill.	.....	1.40
Dallas, Tex.	.....	2.75
Denver, Colo.	.....	2.95
Detroit, Mich.	11.50†	10.50†
Los Angeles, Calif.	3.00*	3.00*
Minneapolis, Minn.	1.70	1.40
Montreal, Que.	15.00†	.....
New Orleans, La.	.....	1.75
New York, N. Y.	.....	3.69*
St. Louis, Mo.	.....	.70*
San Francisco, Calif.	.....	1.90
Seattle, Wash.	3.25	2.75

*280-bbl. (net). †Per ton.

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags.

Atlanta, Ga. (bags)	3.45
Boston, Mass.	2.61
Cedar Rapids, Ia.	2.26
Cincinnati, Ohio	2.35
Cleveland, Ohio	2.26
Chicago, Ill.	1.97
Dallas, Tex.	2.80
Davenport, Ia.	2.21
Denver, Colo.	3.10
Detroit, Mich.	2.17
Duluth, Minn.	1.95
Indianapolis, Ind. (cloth sacks) per bbl.	2.51
Kansas City, Mo.	2.30
Los Angeles, Calif.	3.20
Milwaukee, Wis.	2.18
Minneapolis, Minn.	2.24
New Orleans, La.	2.88
New York, N. Y. (includes bags)	2.35
(10c per bbl. discount in 10 days)	
Pittsburgh, Pa.	2.02
Portland, Ore. (sacks 15c ea.)	3.20
St. Louis, Mo. (incl. sacks)	2.20
San Francisco, Calif.	2.84
(Pkge. 15c on and off.)	
St. Paul, Minn.	2.24
Toledo, Ohio	2.20
Seattle, Wash.	2.94
F. o. b. Seattle (including sacks)	3.50

NOTE—Add 40c per bbl. for bags.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x36" Weight 1500 lbs. Per M Sq. Ft.	⅜x32x36" Weight 1850 lbs. Per M Sq. Ft.	Wallboard, ⅜x32 or 48", Lengths 6'-10', 1850 lbs. Per M Sq. Ft.
Alabaster, Mich.	3.00	4.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Blue Rapids, Kan.	3.00	4.00	6.00	8.00	10.00	10.50	10.00	.....	23.75	19.00	19.375	20.00	36.75
Eldorado, Okla.	.....	.....	.....	.....	10.00	10.50	10.00	.....	15.50	.....	27.20	29.30	39.55
Fort Dodge, Ia.	3.00	4.00	6.00	8.00@11.00	10.00	10.50	15.45@22.00	.....	25.80	20.00	19.375	20.00	30.00
Garbutt, N. Y.	.....	.....	6.00	8.00	10.00	10.00	.....	7.00	.....	.....	.....	20.00	.....
Grand Rapids, Mich.	3.00	4.00	6.00	8.00	10.00	10.00	18.50	.....	27.25	20.00	19.375	20.00	30.00
Gypsum, Ohio	3.00	4.00	6.00	8.00	10.00	10.00	19.25	7.50	27.95	19.00	19.375	20.00	30.00
Loveland, Colo.	3.00	4.00	6.00	8.00	10.00	10.50	.....	.....	29.80	.....	.....	.....	40.00
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	28.25	21.00	19.375	20.00	30.00
Piedmont, S. D.	.....	.....	6.00	8.00	10.00	10.50	.....	.....	32.25	.....	27.97	31.04	41.18
Plasterco, Va.	4.00	.....	7.00	8.00	10.00	10.00	20.90	.....	29.90	19.00	21.375	22.00	.....
Southard, Okla.	3.00	4.00	6.00	8.00	10.00	10.50	10.00	.....	15.50	.....	26.20	28.70	30.00
Winnipeg, Man.	5.50	5.50	7.00	16.00	16.00	16.00	.....	.....	32.50	18.00	28.50	30.00	35.00

NOTE—Returnable Jute Bags, 15c each, $3.00 per ton; Paper Bags, $1.00 per ton extra.
*Shipment in bulk 25c per ton less; ‡Bond Plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton additional; ||Bulk; (a) Includes sacks.

News of All the Industry

Incorporations

Ohio Gravel Co., Parkersburg, W. Va., has been incorporated at $1,000,000.

Louisiana Sand and Gravel Co., New Orleans, has been incorporated with a capital of $200,000.

The Franklin Limestone Products Co., Wilmington, Del., has been incorporated at $200,000.

Industrial Sand and Gravel Corp., New York, N. Y., has been incorporated at $10,000 by H. P. Schmidt and J. H. Mudge.

Connecticut Sand and Gravel Co., Bridgeport, Conn., has been incorporated at $50,000 by Jonathan Grout, Fairfield, and others.

Black River Sand Corp., Utica, N. Y., has been incorporated at $50,000 by H. V. Owens, H. R. Beebe, Joseph Joerissen, E. H. Stetson and G. H. Hughes.

Midland Sand and Gravel Co., Dallas, Texas, has been incorporated at $200,000 by E. S. Heyser, Dallas; W. C. Callahan, Columbus, Ohio; William McCormick, Dallas.

The National Stone and Tile Corp., San Francisco, Calif., with a capital stock of $50,000, will manufacture stone and tile. The directors are Michael Brown, San Francisco; A. M. Flood, Alameda, and J. Paul Miller.

The Guadalupe Lime and Cement Co., San Francisco, Calif., has been incorporated to manufacture and deal in lime and cement and other building materials; capital stock $1,500,000. The incorporators are Edward H. Kramer, Alameda; Hugh B. Jones, Louis Heckman, Boswell F. King and Maurice H. Fitzgibbon, San Francisco.

Sand and Gravel

Memphis, Tenn.—The steamer Alice, valued at about $10,000 and owned by the Arkansas Gravel Co., was destroyed by fire recently at Arkansas City.

The Bellrose Sand Co., South Ottawa, Ill., have expended $125,000 on replacement of the washing and drying plant at their pit and in purchasing new equipment. They are running 30 per cent normal.

Monroe, La.—The McGuire Cattle Co. has purchased the gravel business and equipment of Steele Brothers. The company secures deliveries from the Victor Gravel Co.'s pit and will sell to the city for street work and also for road construction.

Fairfield, Calif.—It is reported that a large sand and gravel company of Los Angeles plans for a big storage warehouse to represent a total investment of $2,000,000. The plans call for two units, providing a total floor space of over 700,000 sq. ft.

The Wheeling Sand and Gravel Co., Wheeling, W. Va., has taken over the Armstrong Sand Co. The Wheeling company is now operating the Armstrong plant as one of its divisional plants in connection with the recently purchased Wheeling Wall Plaster Co. plant, on the Peninsula.

John W. Rooks, construction material dealer and contractor, of McAlester, Okla., has leased several thousand acres of land near Idabel from which to take sand and gravel and other building and road material and will construct a railroad spur from Idabel to his plant. A steam shovel and other equipment has been purchased for $40,000. He expects to make a specialty of road material and to find a market in southern Oklahoma and northern Texas.

The Rock Island Railroad Co. has bought Howard Island, Mo., which contains a large gravel bed at the head of the island. The gravel will be used for construction work on the Rock Island lines. Switches have been built from the main track and an elevated screen has been built over the track so that the gravel can be pumped in the screen and delivered into the car underneath. The pump is operated by a 200-hp. engine and has a capacity of 300 lb. per minute. The equipment is on a barge and the pipe carrying the water and gravel to the cars is supported by pontoons.

Quarries

The Krueger-Sackman Stone Co., Toledo, Ohio, has been incorporated with a capital of $35,000. The incorporators are Ernest Krueger, Meta H. Krueger, William Bassert and Herman E. Krueger.

Eureka, Utah—The Chief Consolidated Co. has resumed its quarry operations after 30 days' shutdown. Some of the limestone now being quarried will be shipped to Salt Lake Valley smelters.

The Culbert Limestone plants, Grovania, Ga., were partially destroyed by fire on December 5. Plans for rebuilding by January 1 were announced a few days later. The damage was confined to the mill building.

Altoona, Pa.—The Pittsburgh Limestone Co., Pittsburgh and New Castle, an auxiliary to the United States Steel Corporation and one of the largest producers of limestone in the United States, recently removed the surface ground from a large area along Clover creek, in the southern part of Blair county, and will operate two large quarries.

Wapakoneta, Ohio—The Auglaize Stone Co. will shortly be ready to deliver crushed blue limestone rock from its new quarry nine miles north of Wapakoneta. Steam drills are preparing for the first blasting. Operations are being conducted by President Jerry Campbell and a gang of men. S. W. McFarland is treasurer and Lewis Stout, secretary.

The Michigan Limestone and Chemical Co. in the spring will establish a barge canal line and open up a warehouse at Oswego, N. Y., making that city a distributing center for limestone fertilizer, limestone dust and crushed stone. The company has a big plant on the Michigan peninsula. By the use of the barge canal and modern facilities for handling its product, this company claims they can sell in New York for 50 cents a ton less than can the Hudson river companies who are in competition with them. The company has four big steamers, with a fifth, a 700-footer, building. For a time bulk will be broken at Buffalo and the products brought to Oswego by canal for storage, but when the Welland is enlarged they expect to bring stone all the way down in their lake boats.

Gypsum

Lewistown, Mont.—The Northwest Gypsum Products Co. has started up its plant, near Heath, on December 29, employing 30 men. R. H. Calkins, Jr., is president, and G. J. McIntyre, vice president and general manager. The mill has a capacity of 150 tons daily.

The Avery Gypsum Co., capitalized at $10,000,000, has withdrawn from Wisconsin. The company was licensed to do business in Wisconsin, but will transact no more business hereafter in that state. The company may be addressed at 15 Exchange place, Jersey City, N. J., or 205 West Monroe street, Chicago.

Progress, Calif.—The Imperial Gypsum and Oil Co. is now ready to lay track between Maria and the Lagura mountain gypsum beds, having received a new Baldwin locomotive and six cars. The roadbed is graded for 20 miles and three crews and 100 mules are doing the grading. Manager S. W. Dunaway is in charge of the company's camps.

Cement

The Superior Cement Co., Superior, Neb., has been closed down for the purpose of installing new machinery, throwing 200 men out of employment.

The New York and New England Cement and Lime Co's plant at Hudson, N. Y., has closed down temporarily for repairs. The shipping department remains active.

The Bessemer Limestone and Cement Co., Youngstown, Ohio, operating a plant of 1,200,000 bbl. annually, has increased its capital from $1,000,000 to $2,500,000.

San Antonio, Texas—A cement plant, said to be financed by local business men, is to be built in the vicinity of San Antonio and more than $150,000 is already subscribed.

The Security Cement and Lime Co., Hagerstown, Md., is erecting a large reinforced concrete cement storehouse at its Security plant. When completed the storehouse will have a capacity of 107,000 bbl. It is 330 ft. in diameter.

The Olympic Portland Cement Co., Bellingham, Wash., has closed its plant after producing 430,000 bbl. of cement, most of which was sold in Washington, and 90,000 bbl. of which are still in storage. The company will resume operation as soon as the market warrants it. During the last year it employed an average of 150 men and its payroll totaled $200,000. The value of its product exceeded $1,000,000 at manufacturer's price.

Concrete Products

The Albert J. Tschudy Co., Wauwatosa, Wis., has been incorporated at $10,000 as manufacturers and wholesale and retail dealers in cement blocks.

The Union Cement Products Co., Elizabeth, N. J., reports an excellent business in cement blocks and will increase its equipment in the near future.

Warsaw, N. Y.—The title of the E. E. Wheeler Co. has been changed to the New York Concrete Co., Inc. The capitalization and the officers remain as formerly.

The National Cement Monument Co., Memphis, Tenn., reports that during 1921 it shipped 25 carloads of cement monuments besides local orders for other cement products.

Knoxville Cement Products Corp., Nashville, Tenn., has been capitalized at $10,000 by Christian P. Koehn, Herbert L. Koehn, Herman A. Ourin, C. A. Russell and Thomas J. Cline.

Morrisville Concrete Products Co., Trenton, N. J., has been incorporated at $100,000 to deal in concrete products. The incorporators are Charles Simon, Jr., Julius Kish and Morris F. Biddle.

The Monad Construction Co., Green Bay, Wis., has been incorporated at $25,000 to build roads, pavement and deal in all building and road materials. The incorporators are F. A. Taskelson, August F. W. Kringel and Charles J. Weaver.

The Bedford Steam Stone Works Co., has been organized at Bedford, Ind., with a capital stock of $30,000, for the purpose of manufacturing artificial and natural stone. The organizers are A. B. Thornton, F. W. Hackleman and J. O. Gyger.

Manufacturers

The Orton & Steinbrenner Co., Chicago, manufacturers of locomotive cranes has made arrangements with Walter Hasendahl, 1213 Fuller avenue, Los Angeles, Calif., to represent it in that territory.

C. A. White, advertising manager for the Fate-Root-Heath Co. Plymouth, Ohio, has accepted an invitation to speak before the fifth National Crushed Stone Association Convention, to be held in Chicago on January 17, 18 and 19.

The Hercules Powder Co., Wilmington, Del., has made a reduction of $3 a thousand on its No. 6 blasting caps; $5 on No. 8 blasting caps; $1 per hundred on electric blasting caps. The revision made in quantity discounts and supplies may be had upon request to any Hercules office.

The Sturtevant Mill Co., Harrison Square, Boston, Mass., has recently issued a beautiful 96-page cloth-bound catalog, "The Modern Fertilizer Plant." The typography is of the best and the halftone engravings and the drawings, printed on heavy coated paper, are very attractive. The book contains the story of the Sturtevant company's 39 years of development of fertilizer machinery. A 36½x22½-in. drawing showing a complete fertilizer plant is inserted at the back of the book and a detailed description of the plant units is given. Several pages are devoted to general information valuable to the fertilizer manufacturer contributed by Dr. Samuel W. Wiley, president and general manager of Wiley & Co., Inc., Baltimore, Md., one of the leading fertilizer chemists, and operating a laboratory in that city.

Buyers' Bulletin

MANUFACTURERS OF MACHINERY AND EQUIPMENT:—These inquiries are live, up-to-date inquiries that have come direct to us from the individual in each case.

READERS OF "ROCK PRODUCTS":—This Department is for your special help and service. If you do not see what you require advertised in "Rock Products," tell us your needs and we will publish them here. There is no charge for this service.

Standard Lime & Stone Co., Fond du Lac, Wis., write us: "Please send us catalogs and prices of combined gasoline engine and hoist for hauling stone to top of lime kilns by cable cars. Car and contents to weigh 4500 lbs. and to be hauled up incline of 45 degrees."

Dunstan, Ltd., N. Kensington Pk., S. Australia, desire catalogs and prices on the following: boilers, dust collecting systems, sand washing boxes and screening equipment.

C. N. Replogle, 913 Bryden Road, Columbus, Ohio, desires catalogs and prices on hydrating equipment, bagging equipment, sacks for hydrated lime and stone cars.

Clayton O. Judson, Engineer, 55 Ballinger Bldg., St. Joseph, Mo., writes us as follows: "I am making a preliminary investigation for the installation of a rock quarry to produce commercial rock to supply local contractors with stone for all classes of concrete work. One location we have in mind will require an Aerial Tramway and the use of Barges. We would be glad to get in touch with sources of information for methods, costs, etc."

Cape May Sand Co., 512 Washington St., Cape May City, N. J., Thomas S. Stevens, Mgr., wants catalogs, prices, etc., regarding gasoline locomotives, standard gauge, that will compare for work and efficiency with steam locomotive 10x16 cylinder. They do not want to consider a steam locomotive.

George W. Hoke, R. F. D. No. 2, West Nilton, Ohio, asks: "Where can I buy the best road machinery for concrete?" He also desires catalogs on wire rope clips, crushers, dragline excavators, hoists, hoisting engines, wagon loaders, motor trucks, steam shovels and wire rope. Also advises that he is now in the market for a second-hand hoist and dragline.

Heimbecher Bros., 210 Guardian Trust Bldg., Denver, Colo., advise that they desire information on machinery for making ornamental concrete work. Want catalogs and prices on cranes, derricks, hoists and screening equipment.

Capital City Sand Co., 308 5th St., Des Moines, Iowa, want prices on revolving sand screens.

G. A. Parkinson, Assistant Testing Engineer, Box L, University Station, Austin, Texas, advises that they desire a small size jaw-type rock crusher for use in the material testing labaratory of the University of Texas.

Saluda River Sand Co., Greenville, S. C., write us as follows: "We would be interested in a small quantity of 8-inch wrought iron pipe to be used in connection with a Morris 8-inch pump. Our plant is located at Pelzer, S. C. One hundred to six hundred feet at a price with flanges, would interest us."

Frank Lanito, 24 N. Main St., Nazareth, Pa., wants catalogs and data on crushers and gasoline engines.

Lycoming Calcining Co., Williamsport, Pa., want to communicate with the manufacturers of machinery for making plaster board.

The Roy C. Whayne Supply Co., 608 W. Jefferson St., Louisville, Ky., is in the market for a 30x36 jaw crusher, or larger size.

Elliott & Sons and R. E. Boggs, of Spartanburg, S. C., are in the market for several jaw crushers.

The Oklahoma Geological Survey, Norman, Okla., desire catalogs for their reference library on the following equipment: machinery for lime burning, cement making, brick making and sand washing. Catalogs should be addressed to Mr. A. C. Shead, Chemist of the Survey.

USED EQUIPMENT WANTED

Gates & Bailey, Elkins, W. Va., are in the market for a limestone pulverizer, capacity 6 to 8 tons per hour.

Shank & Etzler, Frederick, Md., are in the market for a second-hand jaw crusher with 10x20" opening.

Kirk Supply Co., Farmers Bank Bldg., Pittsburgh, Pa., are in the market for a No. 4 Allis-Chalmers or Austin gyratory crusher (used).

Frank Kiesow, Readfield, Wis., is in the market for a used air compressor.

Westmorland Mining Products Co., Greensburg, Pa., are in the market for a No. 4 gyratory crusher; 15 to 25 ton wagon scale and Keystone excavator.

Lisbon Agricultural Lime Co., Attention Frank J. Deemer, Lisbon, Ohio, are in the market for one ½ to ¾-yard gasoline traction crusher; one rotary kiln complete; one rotary crusher, capacity 50 tons per day; one elevating conveyor for coal (coal to be taken up the side of a hill).

Norton Stone & Lime Co., Cobleskill, N. Y., are in the market for an electric shovel, 1½-yard bucket or larger; 18-ton locomotive, 36-inch gauge, steam or electric.

Buyers' Directory
of the Rock Products Industry

AERIAL TRAMWAYS

Bedford Fdy. & Machine Co., Bedford, Ind.
Broderick & Bascom Rope Co., St. Louis, Mo.
Interstate Equipment Co., N. Y. City.
Ruggles Machine Co., Poultney, Vt.

AGITATORS, CLASSIFIERS, THICKENERS, and SLURRY MIXERS

Allen Cone Co., El Paso, Tex.
Dorr Co., N. Y. City.
Meese & Gottfried Co., San Francisco, Calif.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Wahl & Co. H. R., Chicago, Ill.

AUTOMATIC WEIGHERS

Richardson Scale Co., Passaic, N. J.
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.

BAG MACHINERY

Valve Bag Co. of America, Toledo, Ohio.

BAGS

Bates Valve Bag Co., Chicago.
Cleveland-Akron Bag Co., Cleveland, Ohio.
Jaite Co., Jaite, Ohio.
Philadelphia Bag Co., Philadelphia, Pa.
Raymond Bag Co., Middletown, Ohio.
Upson-Walton Co., Cleveland, Ohio.
Valve Bag Co. of America, Toledo, Ohio.

BARRELS

Draper Mfg. Co., Cleveland, Ohio.
International Cooperage Co., Niagara Falls, N. Y.
Knapp Metal Barrel & Package Co., San Francisco, Calif.
Ohio Corrugating Co., Warren, Ohio.
Sandusky Cooperage & Lbr. Co., Toledo, Ohio.

BELT DRESSING

Alexander Bros., Philadelphia, Pa.
Gandy Belting Co., Baltimore, Md.
Mt. Vernon Belting Co., Baltimore, Md.

BELTING

Alexander Bros., Philadelphia, Pa.
Burr Oak Belting Co., Cincinnati, Ohio.
Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
Cleveland Belting & Mach. Co., Cleveland, Ohio —leather, canvas, rubber and cotton.
Morse Chain Co., Ithaca, N. Y.—silent chain.
Corns Conveyor Belt Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.—chain.
Gandy Belting Co., Baltimore, Md.
Mt. Vernon Belting Co., Baltimore, Md.—canvas.
McIlroy Belting & Hose Co., Hammond, Ind.—canvas, cotton and leather-face.
N. Y. Rubber Co., N. Y. City.
N. Y. Belting & Packing Co., N. Y. City.
Quaker City Rubber Co., Philadelphia, Pa.
Union Engineering Co., Cleveland, Ohio—chain.
Upson-Walton Co., Cleveland, Ohio—canvas.

BELT LACING

Alexander Bros., Philadelphia, Pa.
Cleveland Belting & Mach. Co., Cleveland, Ohio.
Flexible Steel Lacing Co., Chicago, Ill.

BIN GATES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Beaumont Mfg. Co., Philadelphia, Pa.
Bacon, Earle C., Inc., N. Y. City.
Greenville Gravel Co., Greenville, Ohio.
Hunt & Co., C. W., Inc., W. New Brighton, N. Y.
Link-Belt Co., Chicago, Ill.
Smith Co., The T. L., Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.

BINS—Storage

Austin-Western Road Machinery Co., Chicago, Ill.
Concrete Silo Co., Bloomfield, Ind.
Macdonald Engineering Co., Chicago, Ill.
Preston Co., J. M., Lansing, Mich.
Sturtevant Mill Co., Boston, Mass.

BLOW TORCHES, HEATERS, THAWING OUTFITS, SNOW MELTERS and BRAZING OUTFITS

Aeroil Burner Co., Inc., Union Hill, N. J.
Cutler-Hammer Co., Milwaukee, Wis.

BODIES—Commercial Car

Columbian Steel Tank Co., Kansas City, Mo.
Easton Car & Constr. Co., Easton, Pa.
Heil Co., Milwaukee, Wis.
Kilbourne & Jacobs Mfg. Co., Columbus, Ohio.
U. S. Motor Truck Co., Cincinnati, Ohio.

BOILERS

Babcock & Wilcox, N. Y. City.
Clyde Iron Works, Duluth, Minn.—steam.
Davis, J. F., & Sons Co., Chicago, Ill.
Edge Moor Iron Works, Edge Moor, Del.
Heine Boiler Co., St. Louis, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Smith, T. L. Co., The, Milwaukee, Wis.

BRICK MACHINERY

Besser Sales Co., Chicago, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Jackson & Church, Saginaw, Mich.
Shope Brick Co., Portland, Ore.
Thayer, L. V., N. Y. City.
Wert Mfg. Co., Chicago, Ill.

BRICK PRESSES

Anderson Fdy. & Mach. Co., Anderson, Ind.
Jackson & Church, Saginaw, Mich.

BUCKETS

Abell-Howe Co., Chicago, Ill.—grab, single-line and automatic.
Atlas Car & Mfg. Co., Cleveland, Ohio.
Austin Machinery Corp., Chicago, Ill.—clamshell.
Industrial Works, Bay City, Mich.—grab.
Browning Co., The, Cleveland, Ohio—clamshell.
Blaw-Knox Co., Pittsburgh, Pa.—clamshell, dredging, digging.
Beach Mfg. Co., Charlotte, Mich.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Columbia Steel Tank Co., St. Louis, Mo.
Clyde Iron Works, Duluth, Minn.—self-dumping.
Godfrey Conveyor Co., Elkhart, Ind.—conveying.
Heyward Co., N. Y. City—clamshell, orange-peel, drag and electric.
Hendrick Mfg. Co., Carbondale, Pa.—elevator.
Hesse-Martin Iron Works, Portland, Ore.—elevator.
Howe Chain Co., Muskegon, Mich.—elevator.
Haiss Mfg. Co., Geo., N. Y. City—clamshell.
Insley Mfg. Co., Indianapolis, Ind.—hoist.
Industrial Works, Bay City, Mich.—grab.
Lakewood Engineering Co., Cleveland, Ohio—clamshell.
Link-Belt Co., Chicago, Ill.—grab, elevator and dragline.
McMyler Interstate Co., Cleveland, Ohio.
Meese & Gottfried Co., San Francisco, Calif.—elevator.
Owen Bucket Co., Cleveland, Ohio.
Orton & Steinbrenner, Chicago, Ill. — elevator, clamshell and orange-peel.
Toepfer & Sons Co., W., Milwaukee, Wis.—elevator.
Weller Mfg. Co., Chicago, Ill.—elevator.

CABLEWAYS

Bedford Fdy. & Mach. Co., Bedford, Ind.
Blaw-Knox Co., Pittsburgh, Pa.—automatic single rope.
Clyde Iron Works, Duluth, Minn.
Flory Mfg. Co., S., Bangor, Pa.—for hoisting, conveying and excavating.
Interstate Equipment Co., N. Y. City.
Lidgerwood Mfg. Co., N. Y. City—hoisting, conveying, excavating and dragline.
Mansfield Eng. Co., Indianapolis, Ind.
Railway & Industrial Engineering Co., Greensburg, Pa.—rocking.
Sauerman Bros., Chicago, Ill.—excavating, dragline and slackline.

CALCINING MACHINERY

Atlas Car & Mfg. Co., Cleveland, Ohio.
Butterworth & Lowe, Grand Rapids, Mich.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Ruggles-Coles Eng. Co., N. Y. City.

CARS

Dump
Atlas Car & Mfg. Co., Cleveland, Ohio.
Continental Car Co. of America, Louisville, Ky.
Easton Car & Constr. Co., Easton, Pa.
Good Roads Mach. Co., Kennett Square, Pa.
International Clay Mach. Co., Dayton, Ohio.
Kilbourne Jacobs Mfg. Co., Columbus, Ohio.
Magor Car Corp., N. Y. City.
Western Wheeled Scraper Co., Aurora, Ill.

Industrial
Austin Mfg. Co., Chicago, Ill.
Easton Car & Constr. Co., Easton, Pa.
International Clay Mach. Co., Dayton, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, Ohio.
Lakewood Eng. Co., Cleveland, Ohio.
Magor Car Corp., N. Y. City.
Watt Car Co., Barnesville, Ohio.
Weller Mfg. Co., Chicago, Ill.

Quarry
Austin Western Road Mach. Corp., Chicago, Ill.
Bacon, Earle C., Inc., N. Y. City.
Easton Car & Constr. Co., Easton, Pa.
Gustafson Mfg. Co., Chattanooga, Tenn.
Insley Mfg. Co., Indianapolis, Ind.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Watt Car Co., Barnesville, Ohio.
Weller Mfg. Co., Chicago, Ill.

Push Cars
Hunt & Co., C. W., Inc., W. New Brighton, N. Y.

CAR PULLERS

Dodge Mfg. Co., Mishawaka, Ind.
Flory Mfg. Co., S., Bangor, Pa.
Godfrey Conveyor Co., Elkhart, Ind.
Meese & Gottfried Co., San Francisco, Calif.
National Hoisting Engine Co., Harrison, N. J.

CAR REPLACERS

Track Equipment Co., Huntington, W. Va.

CEMENT HARDENER

Cal Chemical Co., Hagerstown, Md.

CEMENT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Richardson Scale Co., Passaic, N. J.
Ruggles-Coles Eng. Co., N. Y. City.
Raymond Bros., Impact Pulv. Co., Chicago, Ill.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Weller Mfg. Co., Chicago, Ill.

CEMENT MILL CONTRACTORS

Macdonald Engineering Co., Chicago, Ill.
Smidth & Co., F. L., N. Y. City.

CEMENT MILL REPAIRS

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

CEMENT TESTING APPARATUS

Will Corp., Rochester, N. Y.

CHAIN

Abell-Howe Co., Chicago, Ill.—high-speed drive, power transmission, steel and malleable conveying.
Morse Chain Co., Ithaca, N. Y.—all kinds.
Carroll Chain Co., Columbus, Ohio—steam shovel and crane.
Columbus McKinnon Chain Co., Columbus, Ohio —steam shovel and crane.
Howe Chain Co., Muskegon, Mich.—sprocket, conveyor and elevator.
Jeffrey Mfg. Co., Columbus, Ohio—elevating, conveying and transmission.
Link-Belt Co., Chicago, Ill.
Meese & Gottfried Co., San Francisco, Calif.
Newall Chain Forge & Iron Co., N. Y. City.
Taylor Chain Co., S. G., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—mang. steel.

CLUTCHES

Dodge Mfg. Co., Mishawaka, Ind.—jaw, friction and split.
Hill Clutch Co., Cleveland, Ohio—friction.
Jones Fdy. & Mach. Co., W. A., Chicago, Ill.—friction.
Link-Belt Co., Chicago, Ill.—friction.
Meese & Gottfried Co., San Francisco, Calif.—friction and jaw.
Medart Patent Pulley Co., St. Louis, Mo.—friction.
O. K. Clutch Machinery Co., Columbia, Pa.—friction.

COLORS—For Cement and Mortar

Williams & Co., C. K., Easton, Pa.

Buyers' Directory
of the Rock Products Industry

COMPRESSORS

Chicago Pneumatic Tool Co., N. Y. City—air, portable and stationary.
Curtis Pneumatic Machinery Co., St. Louis, Mo.—air.
Ingersoll-Rand Co., N. Y. City.
Novo Engine Co., Lansing, Mich.—air.
Sullivan Machine Co., Chicago, Ill.—portable, stationary, air.
Worthington Pump & Mach. Corp., N. Y. City.

CONCRETE WATERPROOFING

Cal Chemical Co., Hagerstown, Md.

CONVEYORS

Abell-Howe Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—pan.
Bacon, Earle C., Inc., N. Y. City.
Barber-Greene Co., Aurora, Ill.—self-propelled and belt.
Buchanan Co., C. G., Inc., N. Y. City—belt.
Caldwell, H. W. & Son Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.—belt and chain.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Good Roads Machinery Co., Kennett Square, Pa.
Gridle Fuel Equipment Co., Harvey, Ill.—pneumatic systems.
Godfrey Conveyor Co., Elkhart, Ind.—belt, pan and cableway.
Greenville Gravel Co., Greenville, Ohio—belt.
Hunt & Co., C. W., Inc., W. New Brighton, N. Y.
Hesse Martin Iron Works, Portland, Ore.—chain and belt.
Howe Chain Co., Muskegon, Mich.—chain.
Haiss Mfg. Co., Geo., N. Y. City—belt.
Interstate Equipment Co., N. Y. City.
Jeffrey Mfg. Co., Columbus, Ohio.
Jones Fdy. & Mach. Co., W. A., Chicago, Ill.
Link-Belt Co., Chicago, Ill. — screw, portable, helicoid and belt.
Meese & Gottfried Co., San Francisco, Calif.—pan and belt.
Portable Machinery Co., Passaic, N. J.—belt.
Robins Conveying Belt Co., N. Y. City—belt.
Steacy-Schmidt Mfg. Co., York, Pa.
Smith Engineering Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.—belt.
Universal Road Mach. Co., Kingston, N. Y.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—air.
Worthington Pump & Mach. Corp., N. Y. City.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CRANES

Abell-Howe Co., Chicago, Ill.—electric, hand and portable.
Austin Machinery Corp., Chicago, Ill.
Ball Engine Co., Erie, Pa.—locomotive gantry.
Industrial Works, Bay City, Mich.—steam, gas, crawling tractor.
Byers Machine Co., Ravenna, Ohio—locomotive gantry.
Browning Co., The, Cleveland, Ohio—locomotive and wrecking.
Bucyrus Co., S. Milwaukee, Wis.—locomotive.
Bedford Fdy. & Mach. Co., Bedford, Ind.—traveling.
Bay City Dredge Works, Bay City, Mich.—gas and electric.
Clyde Iron Works, Duluth, Minn.—gantry and traction.
Gramm-Bernstein Motor Truck Co., Lima, Ohio.
Industrial Works, Bay City, Mich.—steam and gas.
Link-Belt Co., Chicago, Ill.—gantry and locomotive.
Maris Bros., Philadelphia, Pa.—electric, hand and traveling.
McMyler Interstate Co., Cleveland, Ohio—locomotive gantry.
Morgan Engineering Co., Alliance, Ohio—overhead traveling gantry and jib.
Northern Eng. Works, Detroit, Mich.—electric traveling and hand traveling.
Ohio Locomotive Crane Co., Bucyrus, Ohio—locomotive gantry.
Orton & Steinbrenner, Chicago, Ill.—locomotive gantry and cantilever.
Osgood Co., The, Marion, Ohio—locomotive gantry.
Thew Shovel Co., The, Lorain, Ohio—power, steam, electric and gas.
Wright Mfg. Co., Canton, Ohio—hand.
Whiting Corp., Harvey, Ill.—all kinds.

CRUSHERS—Jaw and Gyratory

Austin-Western Road Mach. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Beaumont Mfg. Co., Philadelphia, Pa.
Bacon, Earle C., Inc., N. Y. City.
Buchanan Co., C. G., N. Y. City.
Butterworth & Lowe, Grand Rapids, Mich.
Chalmers & Williams, Chicago Heights, Ill.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Fuller-Lehigh Co., Fullerton, Pa.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
Good Roads Machinery Co., Kennett Square, Pa.
Hardinge Co., N. Y. City.
Jeffrey Mfg. Co., Columbus, Ohio.
K-B Pulverizer Co., N. Y. City.
Kennedy-Van Saun Eng. & Mfg. Co., N. Y. City.
Kent Mill Co., Brooklyn, N. Y.
Lewistown Fdy. & Mach. Co., Lewistown, Pa.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Munson Mill Mach. Co., Utica, N. Y.
New Holland Machine Co., New Holland, Pa.
Pennsylvania Crusher Co., Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Smidth & Co., F. L., N. Y. City.
Smith Engineering Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Crusher Co., Cedar Rapids, Iowa.
Universal Road Mach. Co., Kingston, N. Y.
Union Engineering Co., Cleveland, Ohio.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.
Worthington Pump & Mach. Corp., N. Y. City.
Western Wheeled Scraper Co., Aurora, Ill.

CRUSHER REPAIR PARTS
Jaw and Gyratory

American Manganese Steel Co., Chicago Heights, Ill.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

CRUSHING ROLLS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bacon, Earle C., Inc., N. Y. City.
Buchanan Co., C. G., N. Y. City.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.

DERRICKS

American Hoist & Derrick Co., St. Paul, Minn.
Bedford Fdy. & Mach. Co., Bedford, Ind.
Clyde Iron Works, Duluth, Minn.
Gramm-Bernstein Motor Truck Co., Lima, Ohio.
Hayward Company, N. Y. City.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., N. Y. City.
National Hoisting Engine Co., Harrison, N. J.
Superior Iron Works, Superior, Wis.
Terry Mfg. Co., N. Y. City.

DEWATERING MACHINES

Wahl & Co., H. R., Chicago, Ill.

DIPPER TEETH.

American Manganese Steel Co., Chicago Heights, Ill.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

DRAGLINES

Austin Machinery Corp., Chicago, Ill.
Bucyrus Co., S. Milwaukee, Wis.
Good Roads Machinery Co., Kennett Square, Pa.
Marion Steam Shovel Co., Marion, Ohio.
Pawling & Harnischfeger, Milwaukee, Wis.

DREDGES

Bucyrus Co., S. Milwaukee, Wis.—dipper and hydraulic.
Bay City Dredge Works, Bay City, Mich.—track, walking and crawling types.
Ellicott Machine Corp., Baltimore, Md.—hydraulic.
Flory Mfg. Co., Bangor, Pa.
Morris Machine Works, Baldwinsville, N. Y.—hydraulic.

DREDGE SLEEVES

Berry Flexible Pipe Joint Co., Philadelphia, Pa.
Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
N. Y. Rubber Co., N. Y. City.

DRILL STEEL SHARPENING MACHINES

Denver Rock Drill Mfg. Co., Denver, Colo.
Sullivan Machinery Co., Chicago, Ill.
Ingersoll-Rand Co., N. Y. City.

DRILLS

Armstrong Mfg. Co., Waterloo, Iowa.
American Well Works, Aurora, Ill.—blast hole, well and pumping.
Denver Rock Drill Mfg. Co., Denver, Colo.—rock.
Chicago Pneumatic Tool Co., N. Y. City—rock.
Hardsocg Wonder Drill Co., Ottumwa, Iowa.
Ingersoll-Rand Co., N. Y. City—air, steam and electric.
Jeffrey Mfg. Co., Columbus, Ohio.
Keystone Driller Co., Beaver Falls, Pa.
Loomis Machine Co., The, Tiffin, Ohio.
Penn Drilling Co., Pittsburgh, Pa.
Sanderson Cyclone Drill Co., Orrville, Ohio.
Sullivan Machine Co., Chicago, Ill.—hammer and tripod.
Star Drilling Machine Co., Akron, Ohio.
Wood Drill Works, Paterson, N. J.

DRILLERS

Pennsylvania Drilling Co., Pittsburgh, Pa.

DRYERS—Rotary and Vertical

Aeroil Burner Co., Inc., Union Hill, N. J.
American Process Co., N. Y. City.
Grindle Fuel Equipment Co., Harvey, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Lewistown Fdy. & Mach. Co., Lewistown, Pa.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Union Eng. Co., Cleveland, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.
Malcolmson Eng. & Mach. Corp., Chicago, Ill.
Prindle Co., W. E., Columbus, Ohio.
Ruggles-Coles Eng. Co., N. Y. City.
Weller Mfg. Co., Chicago, Ill.

DRYERS—Tower

Bacon, Earle C., Inc., N. Y. City.
Kennedy Van Saun Eng. & Mfg. Co., N. Y. City.
Traylor Eng. & Mfg. Co., Allentown, Pa.

DUST COLLECTING SYSTEMS

Allen Engineering & Mfg. Co., Savannah, Ga.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Clark Dust Collecting System Co., Chicago, Ill.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Steacy-Schmidt Mfg. Co., York, Pa.
Sly Mfg. Co., The W. W., Cleveland, Ohio.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.

ELECTRIC HAULAGE SYSTEMS

Woodford Engineering Co., Chicago, Ill.

ELECTRIC MOTORS, TRANSFORMERS, GENERATORS, DYNAMOS, ETC.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cook Motor Co., The, Delaware, Ohio.
Fairbanks Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Co., E. Pittsburgh, Pa.
Sorgel El. Co., Milwaukee, Wis.
Ideal El. & Mfg. Co., Mansfield, Ohio.
Crawford Mfg. Co., N. Y. City.

ELEVATORS

Austin-Western Road Mach. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bacon, Earle C., Inc., N. Y. City.
Barber-Greene Co., Aurora, Ill.—bucket.
Buchanan Co., C. G., Inc., N. Y. City—bucket.
Caldwell & Son Co., H. W., Chicago, Ill.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Good Roads Machinery Co., Kennett Square, Pa.
Greenville Gravel Co., Greenville, Ohio—bucket.
Hesse-Martin Iron Works, Portland, Ore.—bucket.
Howe Chain Co., Muskegon, Mich.
Haiss Mfg. Co., Geo., N. Y. City.
Interstate Equipment Co., N. Y. City.
Jeffrey Mfg. Co., Columbus, Ohio—bucket.
Lewistown Fdy. & Mach. Co., Lewistown, Pa.
Link-Belt Co., Chicago, Ill.
Meese & Gottfried Co., San Francisco, Calif.—bucket.
Robins Conveying Belt Co., N. Y. City—bucket.
Steacy-Schmidt Mfg. Co., York, Pa.
Smith Eng. Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.

Buyers' Directory
of the Rock Products Industry

Sturtevant Mill Co., Boston, Mass.
Smith Co., The T. L., Milwaukee, Wis.
Toepfer & Sons Co., W., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Road Mach. Co., Kingston, N. Y.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.

ENGINEERS

Arnold & Weigel, Woodville, Ohio.
Bacon, Earle C., Inc., N. Y. City.
Buckbee Co., J. C., Chicago, Ill.
Fuller Eng. Co., Allentown, Pa.
Hatch, James N., Chicago, Ill.
Hunt & Co., R. W., Chicago, Ill.
Malcolmson Engineering Corp., Chicago, Ill.
Prindle Co., W. E., Columbus, Ohio.
Randolph-Perkins Co., Chicago, Ill.
Steacy-Schmidt Mfg. Co., York, Pa.
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.
Sturtevant Mill Co., Boston, Mass.
Smidth & Co., F. L., N. Y. City.
Webster Mfg. Co., Chicago, Ill.

ENGINES

Anderson Fdy. & Mach. Co., Anderson, Ind.—oil.
Hadfield-Penfield Steel Co., Bucyrus, Ohio—oil.
Ideal Engine Co., Lansing, Mich.—gas.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—steam.
Chicago Pneumatic Tool Co., N. Y. City—gas, oil and steam.
Clyde Iron Works, Duluth, Minn.—drag scraper and car pulling.
Cook Motor Co., The, Delaware, Ohio.
Ellicott Mach. Corp., Baltimore, Md.—pumping.
Fairbanks, Morse & Co., Chicago, Ill.—gas and oil.
S. Flory Mfg. Co., Bangor, Pa.—dredging and hoisting.
Good Roads Machinery Co., Kennett Square, Pa.—gas and steam.
Ingersoll-Rand Co., N. Y. City—oil and steam.
Kahlenberg Bros. Co., Two Rivers, Wis.
Morris Machine Works, Baldwinsville, N. Y.—stationary and marine.
Novo Engine Co., Lansing, Mich.—gas and kerosene.
Power Mfg. Co., Marion, Ohio—heavy duty oil.
Smith Co., The T. L., Milwaukee, Wis.—steam.
Superior Iron Works, Superior, Wis.—hoisting.
Strait Mfg. Co., H. N., Kansas City, Mo.—gas.
Venn-Severin Mach. Co., Chicago, Ill.—oil.

EXCAVATING MACHINERY

Ball Engine Co., Erie, Pa.
Bucyrus Co., S. Milwaukee, Wis.
Cable Excavator Co., Fernwood, Pa.—dragline cableway.
Good Roads Machinery Co., Kennett Square, Pa.—dragline.
Hayward Co., N. Y. City—dragline.
Keystone Driller Co., Beaver Falls Pa.
Owen Bucket Co., Cleveland, Ohio.
Orton & Steinbrenner, Chicago, Ill.—dragline.
Link-Belt Co., Chicago, Ill.—dragline cableway.
Smith Co., The T. L., Milwaukee, Wis.
Sauerman Bros., Chicago, Ill.—cableway.
Thew Shovel Co., Lorain, Ohio.
Union Eng. Co., Cleveland, Ohio.

EXPLOSIVES and BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.
Hercules Powder Co., Wilmington, Del.

FEEDERS

Buchanan Co., C. G., Inc., N. Y. City—rotary.
Link-Belt Co., Chicago, Ill.—apron.
Maddox Fdy. & Mach. Co., Archer, Fla.
Meese & Gottfried Co., San Francisco, Calif.—belt and apron.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Traylor Eng. & Mfg. Co., Allentown, Pa.—apron, pan, grizzly and roller.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—automatic.
Weller Mfg. Co., Chicago, Ill.

FUEL OIL SYSTEMS

Flinn & Dreffein Co., Chicago, Ill.
Bowser & Co., Inc., S. F., Ft. Wayne, Ind.

FUSE—Blasting

Ensign-Bickford Co., Simsbury, Conn.
Economy Fuse & Mfg. Co., Chicago, Ill.

GAS PRODUCER PLANTS

Chapman Eng. Co., Mt. Vernon, Ohio.
Flinn & Dreffein Co., Chicago, Ill.
Morgan Construction Co., Worcester, Mass.
Wood & Co., R. D., Philadelphia, Pa.

GEARS

Albaugh-Dover Co., Chicago, Ill.
H. W. Caldwell & Son Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.—conveyor and friction.
Foote Bros. Gear & Mach. Co., Chicago, Ill.—spur, bevel, miter, spiral, worm, internal, helical, tractor, traction engine and heavy duty.
Ganschow & Co., Chicago, Ill.
Hill Clutch Co., Cleveland, Ohio.
James Mfg. Co., D. O., Chicago, Ill.—worm, spiral, herringbone, bevel and spur.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.—spring, compensating, silent chain.
Meese & Gottfried Co., San Francisco, Calif.—spur, bevel, miter, worm, cut.
Medart Patent Pulley Co., St. Louis, Mo.
Philadelphia Gear Works, Philadelphia, Pa.
Plamondon Mfg. Co., A., Chicago, Ill.
Superior Iron Works Co., Superior, Wis.—hand steering.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio—spur, bevel and tooth.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.—mang. steel.
Weller Mfg. Co., Chicago.

GLASS SAND EQUIPMENT

Richardson Scale Co., Passaic, N. J.
Lewistown Fdy. & Mach. Co., Lewistown, Pa.

GRATES

Kramer Bros. Fdy. Co., The, Dayton, Ohio.

HOISTS

Austin-Western Road Mach. Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Bacon, Earle C., Inc., N. Y. City.
Bedford Fdy. & Mach. Co., Bedford, Ind.—power.
Beach Mfg. Co., Charlotte, Mich.—double-drum.
Chicago Pneumatic Tool Co., N. Y. City—air.
Denver Rock Drill Mfg. Co., Denver, Colo.—light portable.
Columbian Steel Tank Works, Kansas City, Mo.
Clyde Iron Works, Duluth, Minn.—belt, steam, electric, portable, gas and high speed.
Erie Clutch & Pulley Co., Erie, Pa.—belt, chain, electric, gas and kerosene.
Fairbanks, Morse & Co., Chicago, Ill.
Flory Mfg. Co., S., Bangor, Pa.—belt and electric.
Good Roads Mach. Co., Kennett Square, Pa.—drum.
Godfrey Conveyor Co., Elkhart, Ind.
Heil Co., Milwaukee, Wis.—hydraulic.
Hunt & Co., C. W., Inc., W. New Brighton, N. Y.
Ideal Engine Co., Lansing, Mich.—gas.
Ingersoll-Rand Co., N. Y. City.
Jeffrey Mfg. Co., Columbus, Ohio—skip.
Lidgerwood Mfg. Co., N. Y. City—steam, electric and gas.
Link-Belt Co., Chicago, Ill.—electric.
Meese & Gottfried Co., San Francisco, Calif.—plain, geared and friction.
Maris. Bros., Inc., Philadelphia, Pa.
Northern Eng. Works, Detroit, Mich.—electric, monorail, air and pneumatic.
Novo Engine Co., Lansing, Mich.—gas and electric.
National Hoisting Engine Co., Harrison, N. J.—steam, electric and gas.
O. K. Clutch & Machinery Co., Columbia, Pa.—gas and electric.
Patten Mfg. Co., Chattanooga, Tenn.—gas and electric.
Robins Conveying Belt Co., N. Y. City.
Superior Iron Works, Superior, Wis.
Sullivan Machinery Co., Chicago, Ill.—portable.
Thomas Elevator Co., Chicago, Ill.—electric, steam and gas.
Vulcan Iron Works, Wilkes-Barre, Pa.
Wright Mfg. Co., Canton, Ohio.

HOSE—Water, Steam, Pneumatic, Air Drill

Chicago Pneumatic Tool Co., N. Y. City.
Cincinnati Rubber Co., Cincinnati, Ohio.
Mulconroy Co., Philadelphia, Pa.
N. Y. Belting & Packing Co., N. Y. City.
N. Y. Rubber Co., N. Y. City.
Quaker City Rubber Co., Philadelphia, Pa.

HYDRATING EQUIPMENT

Atlas Car & Mfg. Co., Cleveland, Ohio.
Kritzer Co., The, Chicago, Ill.
Miscampbell Co., H., Duluth, Minn.
Raymond Bros., Impact Pulv. Co., Chicago, Ill.
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.
Toepfer & Sons Co., W., Milwaukee, Wis.

INSULATION

Celite Products Co., Chicago, Ill.

IRON CASTINGS

Anderson Fdy. & Mach. Co., Anderson, Ind.
Easton Car & Constr. Co., Easton, Pa.
Hesse-Martin Iron Works, Portland, Oregon.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Los Angeles Fdy. Co., Los Angeles, Calif.
Morgan Engineering Co., Alliance, Ohio.
Nortmann Duffke Co., Milwaukee, Wis.
Steacy-Schmidt Mfg. Co., York, Pa.
Strait Mfg. Co., H. N., Kansas City, Mo.
Traylor Eng. & Mfg. Co., Allentown, Pa.

KILNS

Arnold & Weigel, Woodville, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Blaw-Knox Co., Pittsburgh, Pa.
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Ruggles Coles Eng. Co., N. Y. City.
Steacy-Schmidt Mfg. Co., York, Pa.
Smidth & Co., F. L., N. Y. City.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

LABORATORY EQUIPMENT

Eimer & Amend, N. Y. City.
Sturtevant Mill Co., Boston, Mass.

LIME HANDLING EQUIPMENT

Link-Belt Co., Chicago, Ill.

LIME PACKERS

Valve Bag Co. of America, Toledo, Ohio.

LOADERS

Austin Machinery Corp., Chicago, Ill.—wagon.
Ball Engine Co., Erie, Pa.
Barber-Greene Co., Aurora, Ill.—bucket.
Bay City Dredge Works, Bay City, Mich.
Galion Iron Works, Galion, Ohio.
Haiss Mfg. Co., Geo., N. Y. City.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Chicago, Ill.—box car.
Myers-Whaley Co., Knoxville, Tenn.
Ottumwa Box Car Loader Co., Ottumwa, Iowa—box car.
Orton & Steinbrenner, Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Smith Co., The T. L., Milwaukee, Wis.
Thew Shovel Co., Lorain, Ohio.
Weller Mfg. Co., Chicago, Ill.

LOCOMOTIVES—Electric and Storage Battery

Atlas Car & Mfg. Co., Cleveland, Ohio.
Baldwin Locomotive Wks., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

LOCOMOTIVES—Gasoline

Austin Machinery Corp., Chicago, Ill.
Brookville Truck & Tractor Co., Brookville, Pa.
Cummings Machine Co., Minster, Ohio.
Easton Car & Constr. Co., Easton, Pa.
Fate-Root-Heath Co., Plymouth, Ohio.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Whitcomb Co., Geo. D., Rochelle, Ill.

LOCOMOTIVES—Steam

Baldwin Locomotive Wks., Philadelphia, Pa.
Lima Locomotive Wks., Lima, Ohio.
Porter Co., H. K., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

Buyers' Directory
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LUBRICANTS

Adam Cook's Sons Co., N. Y. City.
Standard Oil Co., Chicago, Ill.

LUBRICATING SYSTEMS

Bowser & Co., S. F., Ft. Wayne, Ind.

MANILA ROPE

Hunt & Co., C. W., Inc., W. New Brighton, N. Y.
Meese & Gottfried Co., San Francisco, Calif.
Upson Walton Co., Cleveland, Ohio.
Waterbury Co., N. Y. City.

MECHANICAL RUBBER GOODS

Goodrich Rubber Co., Akron, Ohio.
Goodyear Rubber Co., Akron, Ohio.
N. Y. Belt & Pack. Co., N. Y. City.
Quaker City Rubber Co., Philadelphia, Pa.

MILLS—Grinding

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Hardinge Co., N. Y. City.
Munson Mill Machine Co., Utica, N. Y.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.

MIXERS

Blystone Mfg. Co., Cambridge Springs, Pa.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Smith Co., The T. L., Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Union Eng. Co., Cleveland, Ohio.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.

MOTOR TRUCKS

Autocar Co., Ardmore, Pa.
American Steam Truck Co., Chicago, Ill.
Brookville Truck & Tractor Co., Brookville, Pa.
Clark Trucktractor Co., Chicago, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Federal Motor Truck Co., Detroit, Mich.
Gramm Bernstein Motor Truck Co., Lima, Ohio.
General Motors Truck Co., Pontiac, Mich.
Kilbourne & Jacobs Mfg. Co., Columbus, Ohio.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Sterling Motor Truck Co., Milwaukee, Wis.
Titan Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Traylor Eng. & Mfg. Co., Allentown, Pa.
U. S. Motor Truck Co., Cincinnati, Ohio.

PACKINGS—Sheet, Piston, Superheat, Hydraulic

Cincinnati Rubber Co., Cincinnati, Ohio.
N. Y. Belting & Packing Co., N. Y. City.
Quaker City Rubber Co., Philadelphia, Pa.

PERFORATED METAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Perforating Co., Chicago, Ill.
Cross Eng. Co., Carbondale, Pa.
Harrington & King Perf. Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Nortmann Duffke Co., Milwaukee, Wis.
Toepfer & Sons Co., W., Milwaukee, Wis.

PINIONS—Rawhide and Bakelite

Foote Bros. Gear & Machine Co., Chicago, Ill.
James, D. O. Mfg. Co., Chicago, Ill.

PIPE

Blaw-Knox Co., Pittsburgh, Pa.
Foster Co., L. B., Inc., Pittsburgh, Pa.

PLASTER MACHINERY

Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Butterworth & Lowe, Grand Rapids, Mich.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Union Engineering Co., Cleveland, Ohio.

PNEUMATIC WATER SYSTEMS

Barnes Mfg. Co., Mansfield, Ohio.

PORTABLE BUILDINGS

Blaw-Knox Co., Pittsburgh, Pa.

POWER LINE RACK—Portable

France Fdy. & Mach. Co., Toledo, Ohio.

POWER TRANSMISSION MACHINERY

Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Hill Clutch Co., Cleveland, Ohio.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Medart Patent Pulley Co., St. Louis, Mo.
Munson Mill Machine Co., Utica, N. Y.
Weller Mfg. Co., Chicago, Ill.

PULLEYS

Buchanan Co., C. G., Inc., N. Y. City—magnetic.
Dodge Mfg. Co., Mishawaka, Ind.
Hill Clutch Co., Cleveland, Ohio.
Hesse-Martin Iron Works, Portland, Ore.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Meese & Gottfried Co., San Francisco, Calif.
Medart Patent Pulley Co., St. Louis, Mo.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.

PULVERIZED FUEL EQUIPMENT

Aero Pulverizer Co., N. Y. City.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fuller-Lehigh Co., Allentown, Pa.
Grindle Fuel Equipment Co., Harvey, Ill.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Richardson Scale Co., Passaic, N. J.
Ruggles-Coles Eng. Co., N. Y. City.
Hardinge Co., N. Y. City.
Smidth & Co., F. L., N. Y. City.

PULVERIZERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulverizer Co., St. Louis, Mo.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
Hardinge Co., N. Y. City.
Jeffrey Mfg. Co., Columbus, Ohio.
K-B Pulverizer Co., N. Y. City.
Munson Mill Machinery Co., Utica, N. Y.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.

PUMPS

American Manganese Steel Co., Chicago Heights, Ill.
American Well Works, Aurora, Ill.—sump, quarry, centrifugal, washing and artesian well.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—air slurry and centrifugal.
Barnes Mfg. Co., Mansfield, Ohio—centrifugal, drainage, portable high pressure and force.
Chicago Pneumatic Tool Co., N. Y. City—vacuum.
Ellicott Machine Corp., Baltimore, Md.—centrifugal.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Wks., Medina, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.—gas and oil.
Ideal Engine Co., Lansing, Mich.—gasoline.
Ingersoll-Rand Co., N. Y. City—centrifugal.
Kansas City Hay Press & Tractor Co., Kansas City, Mo.
Keystone Driller Co., Beaver Falls, Pa.
Meese & Gottfried Co., San Francisco, Calif.—centrifugal.
Morris Machine Works, Baldwinsville, N. Y.
Novo Engine Co., Lasning, Mich. — centrifugal, gas and electric.
Nye Steam Pump & Mach. Co., Chicago, Ill.
Sullivan Machinery Co., Chicago, Ill.—air lift.
Smidth & Co., F. L., N. Y. City—slurry.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.
Traylor Eng. & Mfg. Co., Allentown, Pa.—centrifugal.
Worthington Pump & Mach. Corp., N. Y. City—power, centrifugal, steam, plunger.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.—oil, gas and electric.
Wise, Royal C., Chicago, Ill.—centrifugal, steam and electric.

PYROMETERS—Long Distance, Indicating and Recording

Brown Instrument Co., Philadelphia, Pa.
Cleveland Instrument Co., Cleveland, Ohio.
Taylor Instrument Co., Rochester, N. Y.

ROLLERS, GRADERS, SPREADERS and PLANERS

The Austin-Western Road Mach. Co., Chicago, Ill.
Galion Iron Works, Galion, Ohio.
Western Wheeled Scraper Co., Aurora, Ill.

SAFETY DEVICES—Goggles, Respirators, Etc.

Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Willson & Co., Reading, Pa.

SAND CONES

Allen Cone Co., El Paso, Texas.
Smith Eng. Wks., Milwaukee, Wis.
Stephens-Adamson Mfg. Co. Aurora, Ill.

SAND GRINDING PANS

Lewistown Fdy. & Mach. Corp., Lewistown, Pa.

SAND TANKS

Allen Cone Co., El Paso, Texas.
Greenville Gravel Co., Greenville, Ohio.

SCALES

Fairbanks, Morse & Co., Chicago, Ill.
Hunt & Co., C. W., Inc., W. New Brighton, N. Y.
Richardson Scale Co., Passaic, N. J.
Strait Scale Co., Kansas City, Mo.

SCRAPERS

Baker Mfg. Co., Springfield, Ill.
Co-operative Utilities Co., Philadelphia, Pa.—drag.
Green, L. P., Chicago, Ill.—drag.
Sauerman Bros., Chicago, Ill.—drag.
Western Wheeled Scraper Co., Aurora, Ill.

SCREENS

Austin-Western Road Machinery Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—revolving, shaking and conical.
Biesanz Stone Co., Winona, Minn.
Buchanan Co., Inc., C. G., N. Y. City—revolving.
Cross Engineering Co., Carbondale, Pa.
Dodge Mfg. Co., Mishawaka, Ind.—bar and trommel.
Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.
Good Roads Machinery Co., Kennett Square, Pa.—revolving, shaking.
Greenville Gravel Co., Greenville, Ohio—revolving.
Harrington & King Perf. Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Hesse-Martin Iron Works, Portland, Ore.—revolving.
Hardinge Co., N. Y. City.
Haiss Mfg. Co., Geo., N. Y. City—revolving.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Lewistown Fdy. & Mach. Co., Lewistown, Pa.
Meese & Gottfried Co., San Francisco, Calif.—cylindrical.
Nortmann Duffke Co., Milwaukee, Wis.
Newark Wire Cloth Co., Newark, N. J.
Stimpson Equipment Co., Salt Lake City, Utah—vibrating.
Simplex Screen Co., Salt Lake City, Utah.
Smith Engineering Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sturtevant Mill Co., Boston, Mass.
Tyler Co., The W. S., Cleveland, Ohio.
Toepfer & Sons Co., W. Milwaukee, Wis.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Traylor Eng. & Mfg. Co., Allentown, Pa.—revolving.
Universal Road Machine Co., Kingston, N. Y.
Union Eng. Co., Cleveland, Ohio.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—rotary and vibrating.
Worthington Pump & Machinery Corp., N. Y. City.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

SEPARATORS

Buchanan Co., C. G., Inc., N. Y. City—magnetic.
Dings Magnetic Separator Co., Milwaukee, Wis.—magnetic.
Gay Co., Rubert M., N. Y. City.
Link-Belt Co., Chicago, Ill.
Raymond Bros., Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Tyler Co., The W. S., Cleveland, Ohio.

SHEAVES

Chicago Mining Sheave & Roller Co., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Dodge Mfg. Co., Mishawaka, Ind.
Godfrey Conveyor Co., Elkhart, Ind.
Hill Clutch Co., Cleveland, Ohio.
Meese & Gottfried Co., San Francisco, Calif.
Medart Patent Pulley Co., St. Louis, Mo.

Buyers' Directory
of the Rock Products Industry

SHOVELS

Austin Machinery Corp., Chicago, Ill.—steam, gas and electric.
Ball Engine Co., Erie, Pa.—steam.
Browning Co., The, Cleveland, Ohio—steam.
Bucyrus Co., S., Milwaukee, Wis.—steam, electric and gas.
General Electric Co., Schenectady, N. Y.—electric.
Marion Steam Shovel Co., Marion, Ohio—steam.
Orton & Steinbrenner, Chicago, Ill.—steam.
Thew Shovel Co., Lorain, Ohio—steam, electric and gas.
Osgood Co., The, Marion, Ohio—steam.

SHOVEL LOADERS

Lake Superior Loader Co., Duluth, Minn.
Myers-Whaley Co., Knoxville, Tenn.

SKIPS

Atlas Car & Mfg. Co., Cleveland, Ohio.
Bacon, Earle C., Inc., N. Y. City.
Traylor Eng. & Mfg. Co., Allentown, Pa.

SLATE WORKING MACHINERY

Flory Mfg. Co., S., Bangor, Pa.

SPEED TRANSFORMERS—Spur and Worm Gear

Foote Bros. Gear & Machine Co., Chicago, Ill.
James Mfg. Co., D. O., Chicago, Ill.
Jones Fdy. & Mach. Co., Chicago, Ill.

SPROCKETS

Foote Bros. Gear & Mach. Co., Chicago, Ill.
Hill Clutch Co., Cleveland, Ohio.
Hesse-Martin Iron Wks., Portland, Ore.
Jeffrey Mfg. Co., Columbus, Ohio.
Meese & Gottfried Co., San Francisco, Calif.
Medart Patent Pulley Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.

STACKS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Steacy-Schmidt Mfg. Co., York, Pa.

STEAM SHOVEL REPAIR PARTS

American Manganese Steel Co., Chicago Heights, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

STONE GRAPPLE

Superior Iron Works, Superior, Wis.

STONE SCRUBBERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

STORAGE SYSTEMS—Oil and Gas

Bowser & Co., S. F., Ft. Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.

STRUCTURAL STEEL WORK

Blaw-Knox Co., Pittsburgh, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

STUCCO FACINGS

Crown Point Spar Co., Inc., N. Y. City.
Greenstone Products Co., Roanoke, Va.
The Metro-Nite Co., Milwaukee, Wis.

TRACTORS

Atlas Car & Mfg. Co., Cleveland, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Brookville Truck & Tractor Co., Brookville, Pa.
Lombard Auto Tractor Truck Co., N. Y. City.
Clark Trucktractor Co., Chicago, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Troy Wagon Works, Troy, Ohio.
Traylor Eng. & Mfg. Co., Allentown, Pa.

TRANSMISSION MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cleveland Belting & Mach. Co., Cleveland, Ohio.
Greenville Gravel Co., Greenville, Ohio.
Hesse-Martin Iron Works, Portland, Ore.
Morse Chain Co., Ithaca, N. Y.
Union Eng. Co., Cleveland, Ohio.

TURBINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Worthington Pump & Mach. Co., N. Y. City.
De Laval Steam Turbine Co., Trenton, N. J.

TESTING SIEVES AND TESTING SIEVE SHAKERS

Tyler Co., The W. S., Cleveland, Ohio.

TOOL STEEL

International High Speed Steel Co., N. Y. City.

TRACK EQUIPMENT

Atlas Car & Mfg. Co., Cleveland, Ohio.
Central Frog & Switch Co., Cincinnati, Ohio.
Cincinnati Frog & Switch Co., Cincinnati, Ohio.
Easton Car & Constr. Co., Easton, Pa.
Foster Co., Inc., L. B., Pittsburgh, Pa.
Hunt & Co., C. W., Inc., W. New Brighton, N. Y.
Lakewood Eng. Co., Cleveland, Ohio.
Maris Bros., Inc., Philadelphia, Pa.
Weir Frog Co., Cincinnati, Ohio.
Western Wheeled Scraper Co., Aurora, Ill.

TANKS—Storage

Bowser & Co., S. F., Inc., Ft. Wayne, Ind.
Blaw-Knox Co., Pittsburgh, Pa.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Stacey Bros. Gas Constr. Co., Cincinnati, Ohio.
Steacy-Schmidt Mfg. Co., York, Pa.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Weller Mfg. Co., Chicago, Ill.
Wayne Oil Tank & Storage Co., Ft. Wayne, Ind.

UNLOADERS

Galion Iron Works, Galion, Ohio.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Sunbury Mfg. Co., The, Sunbury, Ohio.
Weller Mfg. Co., Chicago, Ill.

USED EQUIPMENT

Birmingham Rail & Locomotive Co., Birmingham, Ala.
Frank, M. K., Pittsburgh, Pa.
Chicago Electric Co., Chicago, Ill.
Davis, J. F., & Sons Co., Chicago, Ill.
Great Lakes Equipment Co., Chicago, Ill.
Heineken, W. P., Co., N. Y. City.
Industrial Equipment Co., Chicago, Ill.
Kleinhans Co., Pittsburgh, Pa.
Lavino & Co., E. J., Philadelphia, Pa.
Machinery & Supply Co., Joplin, Mo.
National Belting & Salvage Co., Milwaukee, Wis.
Reading Engineering Co., N. Y. City.
Ross Power Equipment Co., Indianapolis, Ind.
Wilson & Co., E. H., Philadelphia, Pa.
Zelnicker Supply Co., St. Louis, Mo.

VALVES

Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
Meese & Gottfried Co., San Francisco, Calif.
N. Y. Belting & Packing Co., N. Y. City.
N. Y. Rubber Co., N. Y. City.
Sturtevant Mill Co., Boston, Mass.

WAGONS

The Austin-Western Road Mach. Co., Chicago, Ill.
Troy Wagon Works, Troy, Ohio.
Western Wheeled Scraper Co., Aurora, Ill.

WASHERIES—Sand and Gravel

Link-Belt Co., Chicago, Ill.

WASHERS

Allen Cone Co., El Paso, Texas.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Good Roads Machinery Co., Kennett Square, Pa.
Lewistown Fdy. & Mach. Co., Lewistown, Pa.
Link-Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Wahl & Co., H. R., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

WEIGHING EQUIPMENT

Richardson Scale Co., Passaic, N. J.

WELDING EQUIPMENT

Metal & Thermit Corp., N. Y. City.
Strait Co., H. N., Kansas City, Mo.
Oxweld Acetylene Co., Newark, N. J.

WINCHES

American Hoist & Derrick Co., St. Paul, Minn.
Chicago Pneumatic Tool Co., N. Y. City.
Flory Mfg. Co., S., Bangor, Pa.
Meese & Gottfried Co., San Francisco, Calif.
Superior Iron Works, Superior, Wis.

WIRE CLOTH

Cleveland Wire Cloth & Mfg. Co., Cleveland, Ohio.
Newark Wire Cloth Co., Newark, N. J.
Tyler Co., The W. S., Cleveland, Ohio.
Wright Steel & Wire Co., G. F., Worcester, Mass.

WIRE ROPE

American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Clyde Iron Works, Duluth, Minn.
Dodge Mfg. Co., Mishawaka, Ind.
Leschen & Sons Co., A., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
Sauerman Bros., Chicago, Ill.
Upson-Walton Co., Cleveland, Ohio.
Waterbury Co., N. Y. City.

WHEELS—Car

Easton Car & Constr. Co., Easton, Pa.
Gustafson Mfg. Co., Chattanooga, Tenn.
Meese & Gottfried Co., San Francisco, Calif.
Watt Car Co., Barnesville, Ohio.

KEEP UP WITH THE ROCK PRODUCTS INDUSTRY

TIME and money are saved and won by keeping up with the progress of industry. Changing conditions, methods, prices must be reckoned with to win success. **Rock Products** is the authoritative source of business and technical information in the rock products industry. It is edited from the field by experienced practical men.

Subscribe now and get in correspondence with **our** service and advisory departments.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

REBUILT MACHINERY

8—Jaw Crushers, 6x10 to 15x24.
1—Climax Jaw Crusher, 16x10.
1—Gates Gyratory Crusher, No. 8.
12—Sets Geared Crushing Rolls.
4—Williams' Crushers and Pulverizers.
1—No. 48 American Ring Pulverizer.
1—54"x13" Hardinge Pebble Mill.
1—Braun's Laboratory Pulverizer.
1—Pug Mill.
1—Retort Machine.
4—Brick Machines.
20—Air Compressors, Steam and Belt Driven, 17 to 3000 ft. capacity.
30—Rock Drills, Steam and Air, with Tripods or Column Bars.
1—No. 5 Temple Ingersoll Electric Air Drill, complete.
20—Vertical Steam Boilers, 6 to 45 Hp.
24—Horizontal Steam Boilers, 35 to 180 Hp.
1—Scotch Marine Boiler, 200 Hp.
1—Water Tube Boiler, 400 Hp.
1—Water Tube Boiler, New, 500 Hp.
12—Feed Water Heaters, 50 to 300 Hp.
24—Steam Engines, 4 to 500 Hp.
30—Oil, Gas and Gasoline Engines, 2 to 800 Hp.
1—1200 K. W. Electric Power Plant, complete.
2—Garden City Fans, 110".
1—Sirocco Blower, No. 7.
12—Friction Clutches, 12" to 42".
20—Steam Hoisting Engines.
1—Fairbanks-Morse Gasoline Hoisting Engine, 40 Hp.
4—Gasoline Locomotives.
25—Centrifugal Pumps, 3" to 10" Discharge.
25—Steam Pumps, 1" to 7" Discharge.
1—Triplex Pump, 10x10.
1—Set R. R. Track Scales, New.
1—Oil Storage Tank, Horizontal, 9000 Gal. Cap.
2—Steam Shovels, No. 70-C Bucyrus.

Also the "Clean-up" of the Altoona Cement Plant, North Altoona, Kansas, a bargain lot of Crushing, Pulverizing, Elevating and Conveying Equipment, Steel Buildings, Steel Storage Bins, etc.

The Machinery & Supply Corporation
JOPLIN, MISSOURI

New—RAILS—Relaying

All sections on hand for quick shipment. Reasonable prices quoted. Our stock is very complete.

M. K. FRANK
Frick Building Pittsburgh, Pa.

STEEL RAILS

We offer for immediate shipment the following choice lots of relaying steel rails:
3,000 tons 60 lb., with angles.
2,000 tons 56 lb., with angles.
Free delivery to any point on Illinois Central R. R., south of St. Louis; attractive prices also can be made to any contiguous territory or for export.

600 tons 35 lb., with angles, located at Red Lick, Miss. This rail is well situated for delivery to points in Alabama, Mississippi and Louisiana, or for export.

300 tons each 30 lb. and 35 lb., located Whelen Springs, Arkansas.

250 tons first-quality new 25 lb. billet steel rails, and fastenings, located Austin, Texas.

Terms will be made to responsible buyers. Address inquiries to

Shook & Fletcher Supply Co., Inc.
Birmingham, Ala., or
Birmingham Rail & Locomotive Co.
Birmingham, Ala.

NO. 8-D, GATES GYRATORY CRUSHER

STANDARD DRIVE

Fitted with manganese head and concaves. Included with this crusher, we have the following extra spare parts:

1 New, Manganese head.
1 New, set of manganese concaves.
1 New, main shaft.
1 New, Spider, and 2 New, eccentrics.

We also have many other sizes and types. We specialize in good quarry equipment of all classes. Write us fully.

Reading Engineering Co., Inc.
1227 Tribune Bldg., New York, N. Y.

IMMEDIATE DELIVERY

SEND US YOUR INQUIRY, STEAM SHOVELS.

50—75-hp. Single Drum Hoists, 25 Cy. Motors.
25—40-55 hp. Double Drum Elec. Hoists, 60 cy.
Nos. 3, 5, 6, 7½, 9K, 18K CRUSHERS.
2—6- and 12-Ton Gasoline Locomotives.
10x12-in. Steam Hoist, 3 Drum with Boiler.
65-hp. Locomotive Type Boiler, 100 lbs.
150-hp. Boiler, Buttstrap with Stkr. 156 lbs.
No. 9K GATES CRUSHER, REGULAR DRIVE.
25, 50, 100, 200 Kw. and larger Turbo, Eng. Sets.
50 to 5000 ft. Steam, Belt & Elec. Drive Comp's.
10, 15 and 20 Ton Locomotive Cranes.
LARGE AMOUNT CONTRACTORS' EQUIP., LOCO. CRANES, TOWERS, ETC.

Send us your inquiries for Steam Eng's, Centrif. Pumps, Quarry Equip., Motors, Etc.

Ross Power Equip. Co., Indianapolis, Ind.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25', 3½x25', 4x30', 5½x50' 6x50' and 7x60'; double shell dryers, 4x20', 5x30' and 6x35'; steam-heated air rotary dryers, 4x30' and 6x30'.

KILNS—Rotary kilns, 3½x25', 5x60' and 6x70', 6x100', 7x80' and 8x110'.

MILLS—6x8', 6x5', 2½x3" 3x3½' pebble and ball mills; 8x4', 6x4' and 4x4' continuous ball mills; 3' March mill; 42", 33" and 24" Fuller-Lehigh mills; 4½x20', 5x11', 5x20', 5½x22' and 6x20' tube mills; 7½x13", 9x15", 16x10" and 30x60" jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 36" and 40" cage mills; 3' and 4½' Hardinge mills; 18x12", 20x12" and 30x10" roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 3 roll and No. 000, No. 00 and No. 0 Raymond mills; one No. 5 Telsmith breaker; one 36" Sturtevant emery mill; one 3 roll Griffin mill; 60" chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; one keystone excavator; 6x8', 6x5' and 4x3' Newaygo vibrating screens, Richardson automatic scales.
Air compressors and tanks.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

EQUIPMENT FOR SALE

BOILERS
1—250-H.P. Sterling.
1—300-H.P. B. & W.
2—72"x18' H. F. T. Boilers.
ENGINES
1—24x48 Corliss.
1—18x30 Side Crank Buckeye.
1— 6x 6 Vertical.
1— 6-H.P. Fairbanks and Morse Gasoline.
1—10-H.P. Fairbanks and Morse Gasoline.
WATER HEATERS
1—30 in. x 8 ft. Pittsburg.
1—33 in. x 7 ft. 6 in. Hoppes.
1—30 in. x 7 ft. 6 in. Morrison.
WATER PUMPS
1—5x9x12½x10 in. Compound Duplex Worthington.
1—7x4½x8 Pulling.
STACKS
1—48 in. x 80 ft.
RAIL EQUIPMENT
8—36 in. gauge end dump Quarry Cars.
CRUSHERS
1—30 in. Jeffrey Swinging Hammer Pulverizer.
1—12"x20' Screw Conveyor.
DREDGE MACHINERY
1—Set Dipper Dredge Machinery, 1½ yard Dipper, complete.

THE OHIO GRAVEL BALLAST CO.
2103 Union Central Bldg. Cincinnati, Ohio

FOR RENT AND SALE

13—6-yd. re-built dump cars, std. gauge.
20—12-yd. Westerns, like new, std. gauge.
50—60,000-lb. capacity flat and box cars.
1—Western standard gauge spreader.
1—Osgood 18 revolving shovel, traction wheels, No. 794, ¾-yd. bucket, used 8 mos.
1—Marion 36 combination shovel and drag-line, No. 4725, caterpillar traction, 1 ½-yd. bucket, used 4 mos.; built March, 1921.
1—Marion 76 steam shovel, No. 3503, std. gauge.
1—P. & H. gasoline drag-line and crane, caterpillars, 40' boom, ½-yd. bucket, new 1921.
1—Northwest gasoline drag-line and crane, caterpillars, 40' boom, ½-yd. bucket, new 1921.
1—No. 2 Brown-Hoist four-wheel gasoline crane, std. ga., 40' boom, ½-yd. bucket, new 1921.
LOCOMOTIVES
1—40-ton 17x24 in. four-wheel switcher.
2—NEW 25-ton six-wheel Porters, separate tenders, 36 in. gauge.
2—18, 14, and 10-ton Vulcans, 36 in. gauge.

INDUSTRIAL EQUIPMENT CO.
McCormick Building Chicago, Ill.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

WANTED

Part or all of the following equipment, second-hand, but must be in first class condition:

One No. 3 Clyde Lime Hydrator. Weigh Scales and Hopper for same.

One No. 0 Raymond Pulverizer with automatic throwout.

One 4' 6" Separator for No. 0 Pulverizer.

One 12"x24" Raymond Hydrated Lime Feed.

One 7' 0" dia. Raymond Cyclone Collector.

One 4' 0" dia. Raymond Cyclone Collector.

Address

Box 1525, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Bargains in Machinery

We have for sale the following used machinery, in good condition, subject to prior sale.

1—No. 6 McCully, with extra head and shaft, two extra Master Wheels.
1—42" Trunion Chain Driven Revolving Screen, 18 ft. long.
1—52" Trunion Chain Driven Revolving Screen, 18 ft. long.
1—Thew No. 1 Steam Shovel, on Standard Railroad Gauge, having a one cubic yard dipper, Shop No. 835.
1—National, 3 Drum Hoist—10"x14" Cylinders, 30"x36" Drums.
1—Bay City Clam Shell Bucket, No. 733.
500 feet 2" Cable.

E. J. LAVINO AND COMPANY
Attention Stone Dept.
559 Bullitt Building Philadelphia, Pa.

WANTED

1 Osgood 18 or similar outfit, steam dragline or clamshell and crane, caterpillars, 50' boom, ¾ yard bucket. Give complete description.

HEIMBECHER BROS.
210 Guardian Trust Building
DENVER, COLORADO

WANTED

In good condition, used 10, 12 or 15 ton Porter or Vulcan locomotive. Address

P. O. Box 514, Hartford, Conn.

Classified Advertising

Rates for advertising in the Classified Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

FOR LEASE or WOULD SELL

A well equipped stone quarry with Lime Kilns and Stone Crushing Outfit. In first class shape, and in operation with plenty of stone. Address

Box 1523, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

WANTED

Foreman for small lime and crushing plant. Must be reliable, able to handle men and get results. Business is growing and offers good opportunity to the right man. Give full particulars with reply—age, experience, references and salary expected. Address

Box 1524, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

STEAM SHOVELS

2—Type O Thew, traction, ⅝-yd. dippers.
1—Type A-1 Thew, traction, ⅞-yd. dipper.

Tractor

1—Holt 30-45 Hp. Caterpillar, overhauled, real bargain.

GREAT LAKES EQUIPMENT CO.
327 S. La Salle St. Chicago, Ill.

Idle Machinery Absorbs Profits

This department is the medium for the men who keep the wheels going. Sell your idle machinery to the man who'll keep it going.

WANTED

Position as manager or superintendent of quarry or lime plant. Over 12 years' experience as manager some largest plants in country. Best references from all past connections. Maximum production guaranteed. Address

Box 1526, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

FOR SALE

Half interest in well established quarry known as the Hale Roberts Stone Co., at Alden, Iowa.

For particulars address

Box 1530, care of Rock Products
542 South Dearborn Street, Chicago, Ill.

SUPERINTENDENT

with over 15 years' experience in the construction, operation and maintenance of stone crushing and screening plants, also in the operation and maintenance of steam shovels, locomotives, drills and other modern equipment used in quarrying and excavation work, is now open for position. References furnished. Address

Box 1529, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

FOR SALE
Gates Revolving Screen

60 inches diameter—3-inch ring, length 12 feet. New. Never used. Bargain.

Box 1775, Richmond, Va.

FOR SALE

The Ellsworth Stone Quarry, Iowa Falls, Iowa. Has not been in operation for two years but has plenty of stone and is completely equpiped with machinery.

For full particulars address

Box 1531, Care of Rock Products
542 S. Dearborn St. Chicago, Ill.

WANTED

Mechanical engineer, 20 years' experience, designing, erecting, operating, wishes position with growing cement or quarry concern. 12 years with large portland cement company. Best of references from past and present employers. Address

Box 1532, Care of Rock Products
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125 h.p., 16" by 24" steam engine.
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2—Type B Erie, traction wheels.
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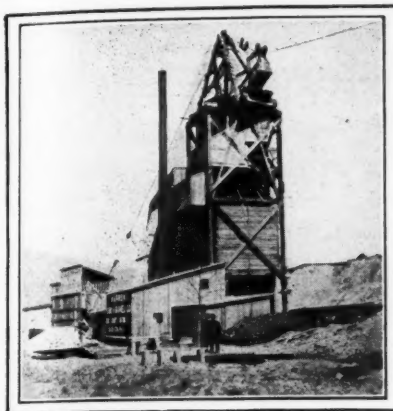

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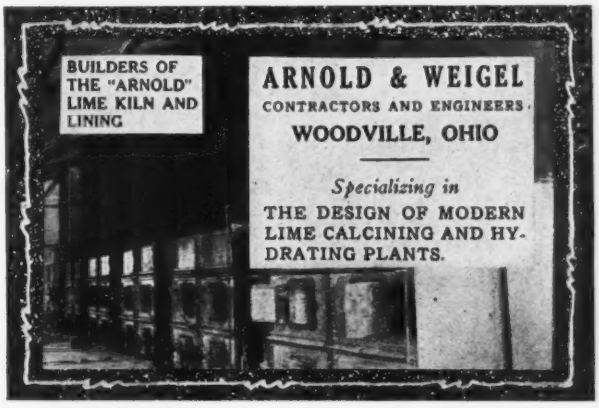
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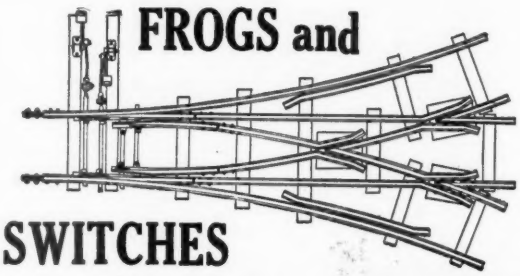

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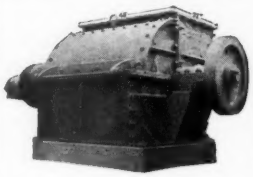

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For Crushing and Pulverizing Limestone, Lime, Gypsum, Shale, etc., a Gruendler cannot be beat.

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Samples and prices sent on request

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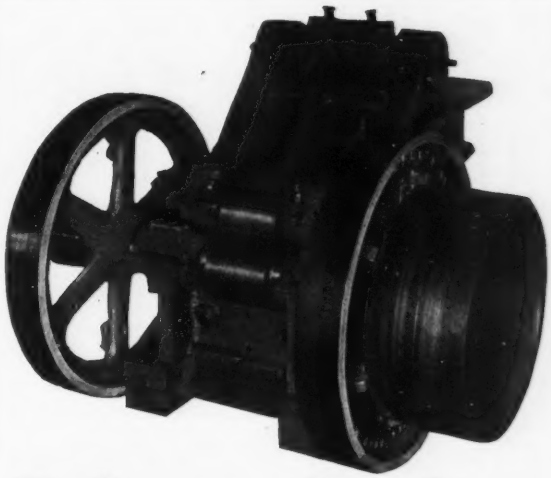

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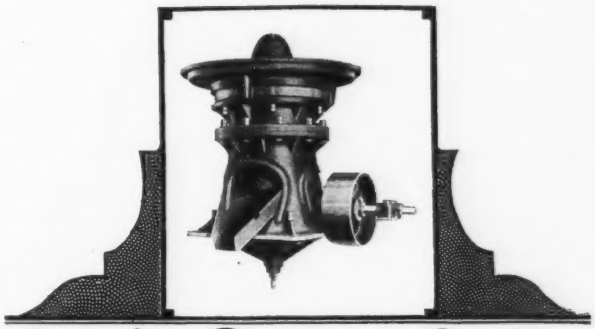

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Stationary and Portable Types

are so designed and constructed as to insure their giving real service and satisfaction over a long period of years.

Exclusive Austin features are responsible for their high production and low upkeep records which combine to make an Austin Crusher

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Catalog No. 28-T describes these dependable crushers in detail, and Elevators, Screens, Cars, Hoists, Bins, etc., as well. It also shows layouts of many successful plants of various sizes and is well worth a place in your file.

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Try us with your next order.

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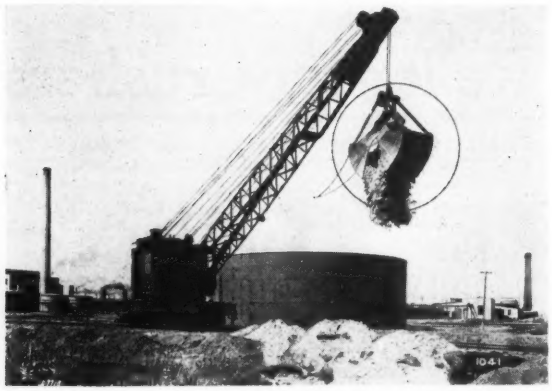

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$725.00 F. O. B. Bedford, for the 1½ cu. yd. Bucket, weighing 4250 pounds and

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These buckets are of the flat link power wheel type and are of heavy substantial construction.

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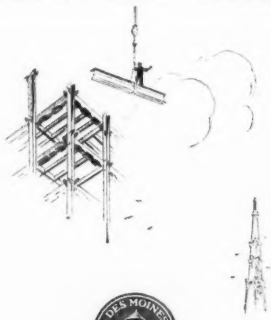

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Whether the job is the largest group of wireless towers in the world (DES MOINES erected these in Bordeaux, France,) or a complete Air Craft Naval Station with numerous auxiliary buildings (DES MOINES erected this large job for the Government at Hawaii), or smaller jobs such as office, store, mill or factory buildings—the same unequalled skill is used in direction and production in each successive process.

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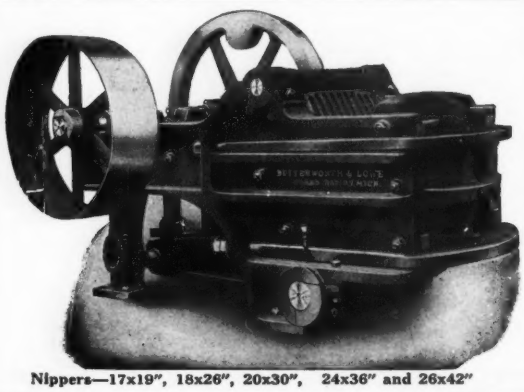

Nippers—17x19", 18x26", 20x30", 24x36" and 26x42"

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For All Rocks and Ores Softer Than Granite

GYPSUM MACHINERY—We design modern Plaster Mills and make all necessary Machinery, including Kettles, Nippers, Crackers, Buhrs, Screens, Elevators, Shafting, etc.

Special Crusher-Grinders for Lime

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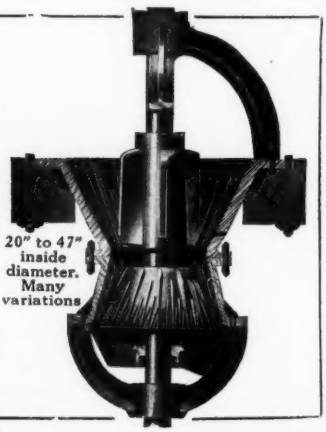

20" to 47" inside diameter. Many variations

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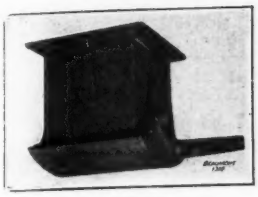

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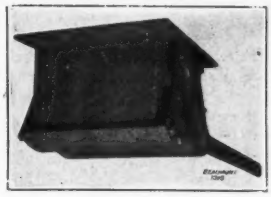

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FOR

SAND—GRAVEL—LIME
CRUSHED STONE, ETC.

Non-Leaking Non-Binding
Normally Closed

12″x12″ TO 24″x24″ SIZES

SEND FOR PRICES—STOCK SHIPMENTS

BEAUMONT MFG. CO.

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RELIABLE in hard ROCK WORK

WHEN you are selecting a steam shovel, you can make absolutely sure that you buy a reliable machine. Inquire of men who have used different steam shovels in ***severe rock work.*** Find out which shovel has given steadiest service in granite, trap, limestone and flint.

You will surely select the one make of shovel that is noted among quarrymen for "Steadiest service; Fewest repairs."

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BALL ENGINE CO., Erie, Pa., U. S. A.
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The Clyde was first in the field, and through dependable and economical performance is still first choice of lime operators.

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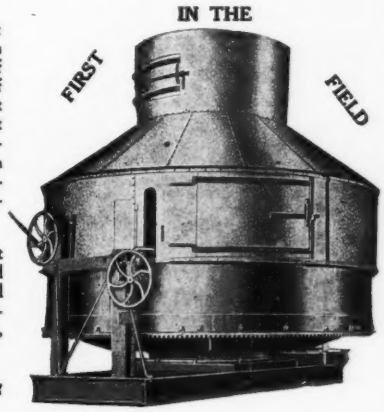
The Clyde not only produces over 90% of the hydrate of America, but makes the best quality of finishing lime from either high calcium or magnesium.

Simple, easiest to operate and most economical in cost of installing, maintaining, and operating.



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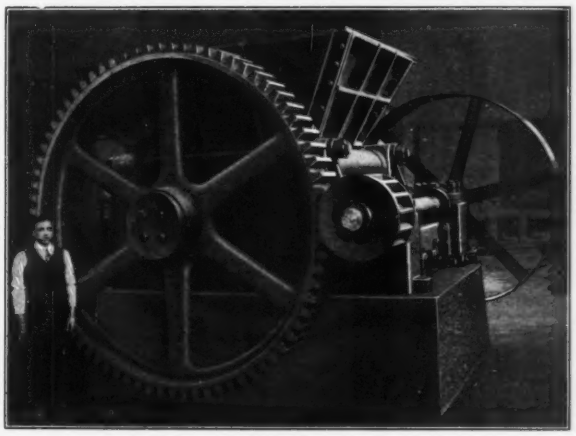

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After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.
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Screens, Elevators, Conveyors, Rock Washers, Etc.

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HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

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Is the one lasting ornament for surfacing Stucco. The natural olive-green color blends in harmony with Nature's color scheme, and age only tends to deepen the shade. The pure white back-ground of stucco, dashed with our No. 48 product, gives you a finish of unequalled beauty and durability.

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Stucco Buildings, Concrete Blocks or Bricks faced with Metro-Nite are beautiful, artistic and everlasting.

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STORAGE BATTERY LOCOMOTIVES—1 TO 8 TONS ON DRIVE WHEELS

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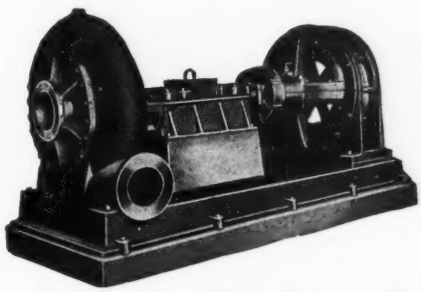

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Where conditions are too severe for our standard sand pump, the above type is recommended.

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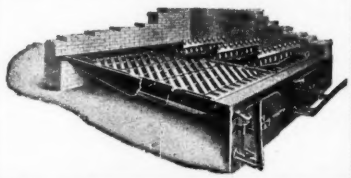

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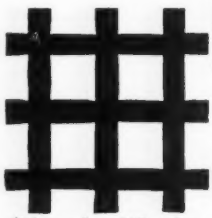
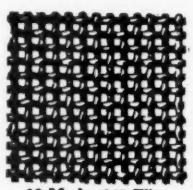


2½ mesh; .105 wire

A uniform fineness is assured by the use of "Cleveland" Double Crimped Wire Cloth, making it unequalled for the screening of Sand, Gravel, Crushed Stone and Cement. "Service" is the definite policy of this organization, and through every phase of manufacture this end is constantly before us.

A large stock always on hand. However, any special mesh will be manufactured to suit requirements. PRICES RIGHT



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THE CLEVELAND WIRE CLOTH AND MANUFACTURING COMPANY

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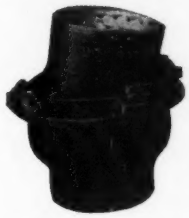
BERRY'S FLEXIBLE PIPE JOINTS



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6" to 12" Without Locking Device. (Made of Cast Steel)

For Pontoon Lines Have Revolutionized Hydraulic Dredge Boat Work

These Joints are made of the best quality cast steel and brass and are stronger than the pipe itself. They will take any angle up to 17 degrees without leaking. If you are troubled with leaking joints on your pipe line, Write Us.

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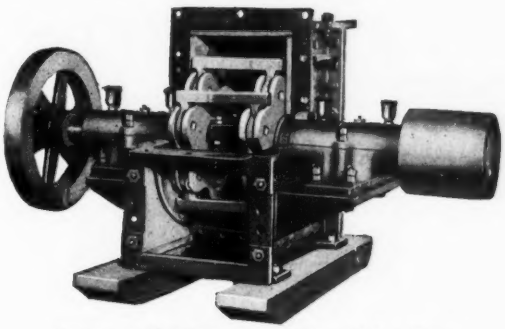

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Does the Material You're Handling Pulverize Your Pulverizer?

All parts of the K-B Pulverizer that come in contact with the material to be crushed are made of Manganese Steel.*

Only STEEL will stand the stress
"K-B" is built ALL-Steel
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**The best material obtainable for the duty required.*

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Best and Most Economical Pumping Equipment for Quarries

Handles largest percentage of foreign matter with water, and with no damage to pump. Suspend it over water hole and swing it out of way when blasting.

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"400 to 450 cu. yds. per 8-hour run in a cut of hard soap-stone formation with little blasting" is the experience of an Oregon Contractor with his

OSGOOD 18

3/4-cu. yd.

Revolving Steam Shovel

mounted on

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THERE ARE REASONS WHY THEY ARE BETTER

Compact mounting permits digging from either end.
All Steel Tread Belts adjustable independently and quickly.
Large bronze bushed Tread Rollers for easy traveling.
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Heavy Gearing and Friction Clutches for paper-mills, rubber-mills, tube-mills, cement-mills, rolling-mills, stone quarries, and rock products, mining and coal-handling machinery, elevators and malt houses, turbines and water wheels, sugar refineries, packing houses, electric light plants, powder-mills, glass factories; cut gears and machine molded gears of all kinds.

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Makers of grey iron, and semisteel castings by analysis.

Special machinery built to order on modern tools at usual shop rates.

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Apply Ford Efficiency, Economy and Service

To Your Quarry Haulage

Standard Ford motors, transmission and heavy Ford ton truck worm drive differentials, supplied with Brookville Attachments, including our patented auxiliary reverse transmission, giving locomotive the Ford ton truck high and low speeds as well as the same pulling power when running either forward or in reverse, making the most practical, efficient and economical light locomotive on the market today. ***No experiment;*** we've been building attachments of this type since 1918.

Three different type frames, sectional oak, 8" ship channel, and a heavy underslung cast iron. Maximum pulling capacity on level from 15 to 25 tons.

Wood frame type as shown above from photograph taken in pit of Trinidad (Colo.) Brick & Tile Co., complete with Ford unit, including cab top and shield $975.00. Heavier iron frames slightly higher in price.

Quotations of letter Trinidad Brick & Tile Co., dated Aug. 20, 1920. "We have increased our output approximately 40% over mule and horse haulage at a decrease of from 20% to 30% per ton."

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What the machine is doing for others, it will do for you. Let us tell you more about it. No obligation.

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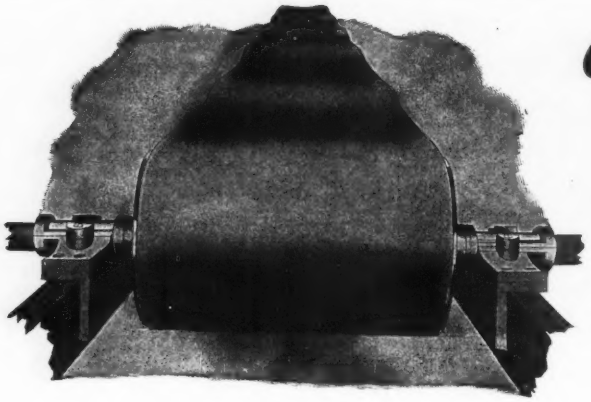
BROOKVILLE, PA., U. S. A.

A. R. Woolridge, 220 King Street, West, Toronto, Canada



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Reduces Your Cost of Handling to a Minimum

Arno Conveyor Belts are manufactured to render unusually long and satisfactory service.

Made of a combination of duck, friction and extra tough rubber cover, they are especially constructed for carrying ores, broken stone, sand, gravel, etc.

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CINCINNATI RUBBER MANUFACTURING CO.

Makers of Belting—Hose—Packings and Molded Specialties

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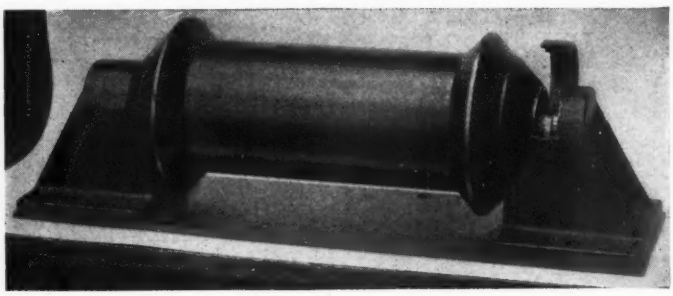


CHICAGO Frictionless Roller Sheave

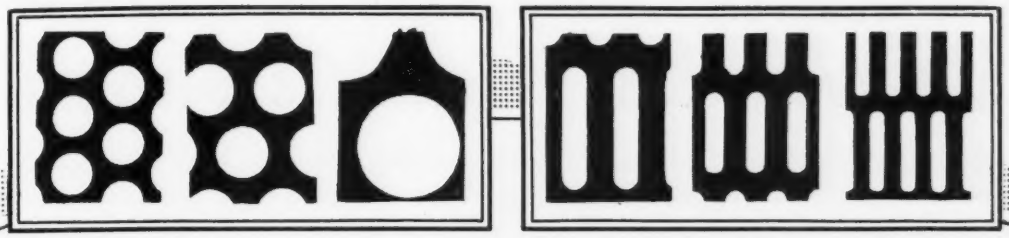
Built for Service—

There is a type of the Chicago Frictionless Roller Sheave made for every slope mine requirement. It is built to stand up under long, hard usage, as it has a double bearing, and is of heavy construction.

This latest development in a mining sheave has a patented oil reservoir that only requires a single occasional oiling to keep it running smoothly. The base and roller are of cast iron, but the center core, which gets most of the strain, is made of the strongest steel.

CHICAGO MINING SHEAVE AND ROLLER CO.

2320 WEST CHICAGO AVENUE - - CHICAGO



PERFORATED STEEL SCREENS

of Every Description

FOR

STONE, GRAVEL, SAND, CEMENT & ALL MINERALS

THE HARRINGTON & KING PERFORATING COMPANY

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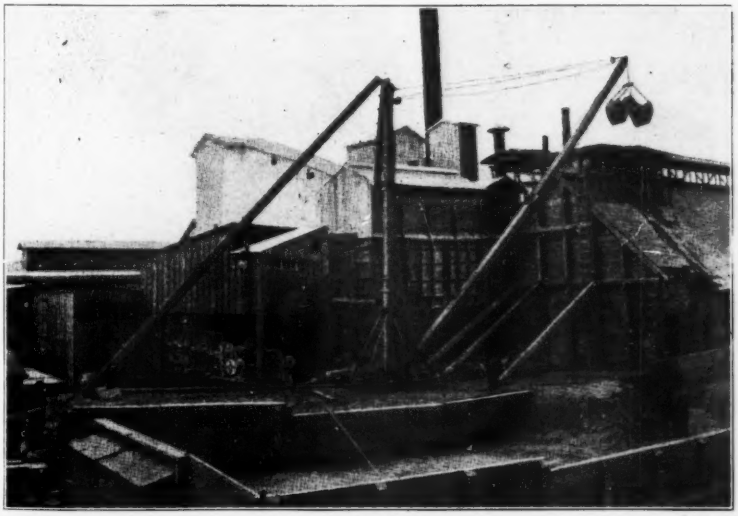
FLORY HOISTS



A FLORY THREE DRUM Hoisting Engine with swinging gear operating a clam shell bucket in connection with guy derrick.

Loading and unloading ing sand, gravel, etc.

Tell us your material handling problem.

Our engineers are at your service.

FLORY CABLEWAYS are extensively used in excavation, hoisting and conveying operations.

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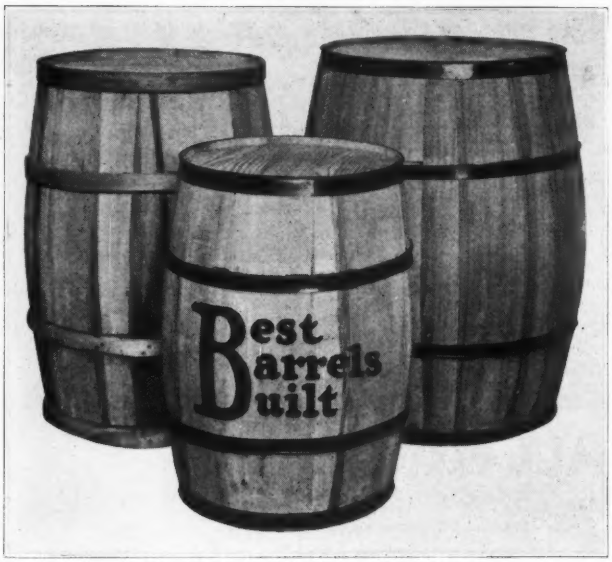
The Wooden Barrel is Superior



THIS organization maintains for your convenience, forty-seven shops and warehouses in central and eastern states; and own or control the output of a large number of stave and heading mills located in the timber district of the Southwest. Therefore we are prepared to deliver the "Best Barrels Built," made of tongued and grooved staves, glued heading, thoroughly Kiln dried, and bound with wood, wire or steel hoops to meet your requirements.

These barrels are practically indestructible, rat, vermin and moisture proof, and meet all the government and railroad requirements for the safe transportation of poisonous substances.

If you are in a hurry, we can supply you.

SANDUSKY COOPERAGE & LUMBER CO., Toledo, Ohio

Shays in Quarry and Gravel Pit

Getting out rock and gravel is usually a crooked, rough track job.

The grades are winding and steep.

The flexible-geared drive of the Shay was designed for just such work.

Sharp curves and steep grades, where a rod engine would be helpless are easy for a Shay.

Multi-cylinder engines and every wheel a driving wheel gives a steady, powerful even pull.

Shays do not cut down output by slipping and stalling.

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Lima, Ohio — 17 East 42nd St., New York

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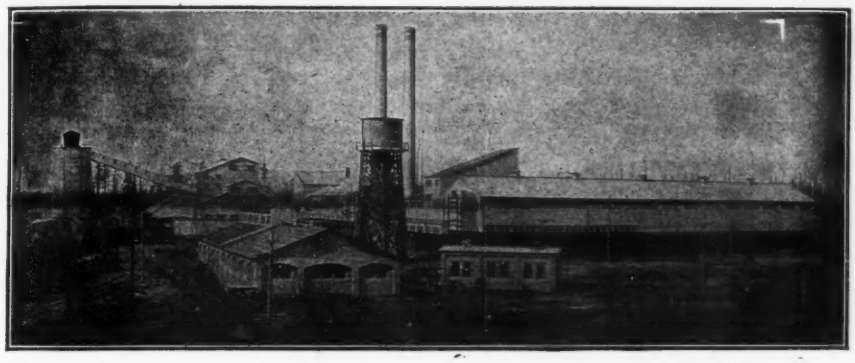

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PHYSICAL AND CHEMICAL TESTS OF MATERIALS. EXAMINATION OF PROPERTIES. APPRAISALS.

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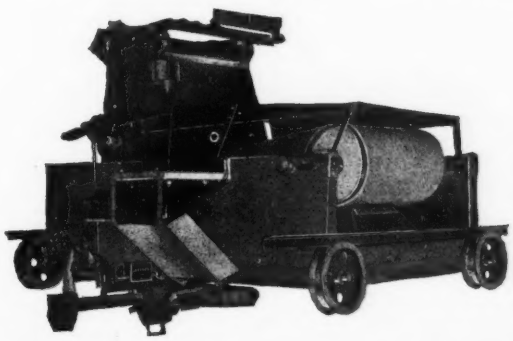
Crushed Stone, Sand, Gravel, Phosphate, Gypsum, Clinker, Glass Sand, Shale, Marl, Clay, Coal and other similar materials



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THE NEW RICHARDSON Automatic Bulk Scale

IS A MARVEL OF ACCURACY AND DURABILITY IN MEASURING AUTOMATICALLY THE WEIGHT OF LUMPY AND GRANULAR MATERIALS OF MANY VARIETIES.

Simplest Automatic Scale Made

It's absolutely Choke-proof and all parts that are touched by material are moisture proof and rust proof.

ACCURATE AND CONTINUOUS RECORDS OF YOUR RAW MATERIALS OR PRODUCT FURNISHED MECHANICALLY FOR DAY AND NIGHT WORK.

A small length, wide, slow speed conveyor belt (part of machine), feeds the material to the scale hopper in a steady stream. Scale weighs in predetermined drafts, discharges and registers automatically.

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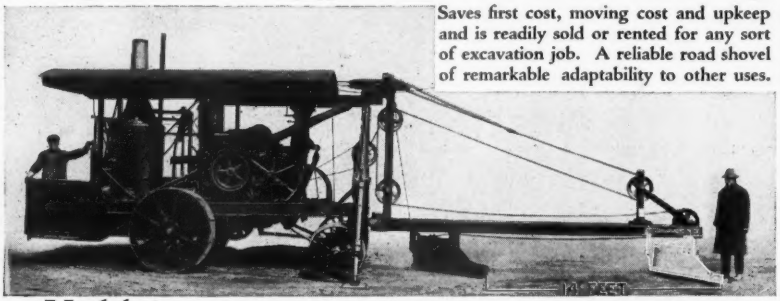
KEYSTONE
REGISTERED U. S. PATENT OFFICE

The KEYSTONE is a highly versatile traction steam shovel with all the efficiency of specialized design, usable with three different interchangeable scoops —*Skimmer, Ditcher and Clam Shell*— for Road Grading, Trenching, Back-Filling, Cellar Digging, Pit Mining, Loading, Unloading and Handling Materials. Can be equipped with electric motor drive for use in buildings.

Saves first cost, moving cost and upkeep and is readily sold or rented for any sort of excavation job. A reliable road shovel of remarkable adaptability to other uses.



Model 4. — 14 ton All Steel Excavator with ½ yd. Skimmer

Keystone Driller Company

170 Broadway, New York Monadnock Block, Chicago Joplin, Mo.

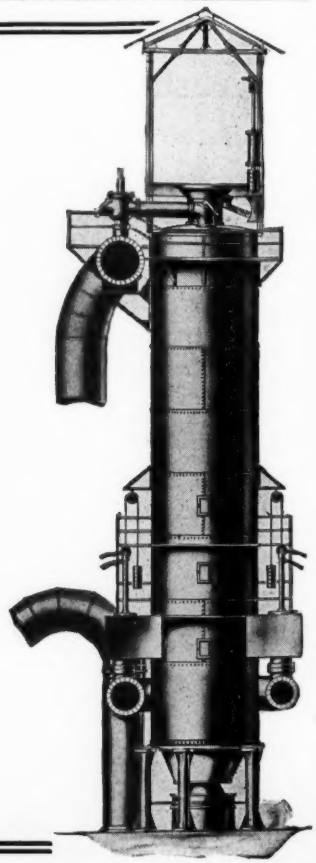
Beaver Falls, Pa.

Continuous Discharge—Gas Fired

LIME KILNS

The wastefulness or efficiency of any lime burning apparatus is determined by the amount of fuel per ton of lime produced.

Our Kilns are not an experiment, but have successfully met the test of years of actual service. The design is the work of our Consulting Mechanical and Chemical Engineer, who has had many years of practical operative experience. They embody a number of labor saving devices, and are designed to secure maximum production with minimum fuel consumption; their record in this respect should interest every lime producer in the country.



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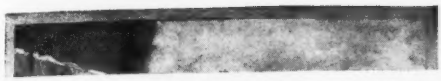
Lynchburg, Va., U. S. A.

Using the Nationally Famous Virginia Foundry Irons

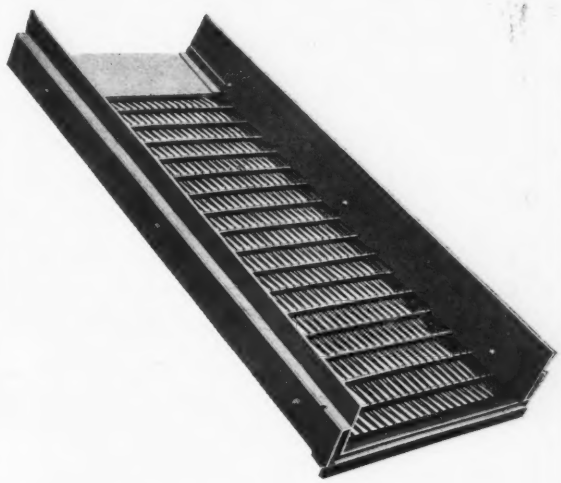


ATLAS EXPLOSIVES
USED ON BIG JOBS EVERYWHERE

Atlas Non-Freezing overcomes the difficulties experienced in cold-weather blasting. It will not freeze under ANY condition. It will not cause headaches from handling. Hundreds of users of their own accord have written us letters stating their appreciation of this explosive. It is the explosive of today. Tell us what explosives you now are using and we will tell you what grade of Atlas Non-Freezing to use for your work.

ATLAS POWDER COMPANY
WILMINGTON, DEL.

Branch Offices:—Allentown, Pa.; Birmingham, Ala.; Boston; Chicago; Houghton, Mich.; Joplin, Mo.; Kansas City; Knoxville; McAlester, Okla.; Mexico City, Mexico; New Orleans; New York; Philadelphia; Pittsburg, Kans.; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis; Wilkes-Barre.



A radical departure in Screens

The Simplex Screen

Gravitation Principle—Wullstein Patents

No Cross Wires
No Openings with Closed Ends
Constantly Increasing Space Between All Teeth

Resulting in

AN ABSOLUTELY NON-CLOGGING SCREEN

No Power
No Labor
Huge Capacities
Efficient Screening
Long Life
Sectional Construction

Permitting Renewal of Desired Part Without Disturbing Other Parts

Simplex Screens now in successful operation handling many different materials.

Outline your requirements to us. Ask for Bulletin 10-B.

SIMPLEX SCREEN CO.

Felt Building **Salt Lake City, Utah**

SHOPE BULLETIN

VOL. I January 14, 1922 Number 10

Competing Successfully—

Shope Concrete Brick, in practically every finish, successfully compete with enameled clay bricks and other decorative specialties.

Despite the fact that this product can be produced at less cost than the clay product, they sell on a quality basis. You don't have to cut prices to compete with any building material, and this with the exclusive territory, protected by basic patents on machinery and process of manufacture, will give you the maximum returns on the sand, crushed stone screenings or crushed slag screenings that you are probably wasting.

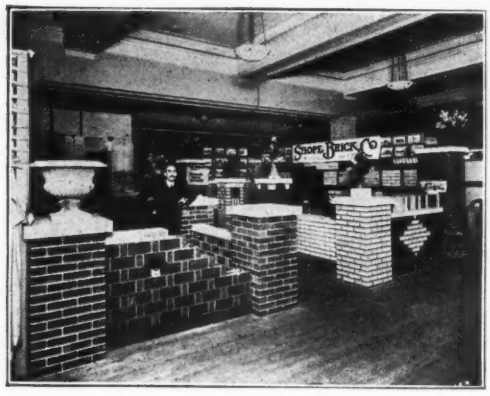


Exhibit of Shope Concrete Brick at Home Builders' Show Portland, Ore.

It will pay you to investigate the possibilities of Shope Concrete Brick, and if your territory is still open, we suggest that you do it now.

Hasten your inquiry—or your territory may be grabbed off
Write for complete information

Shope Brick Company

361 East Morrison Street **Portland, Oregon**

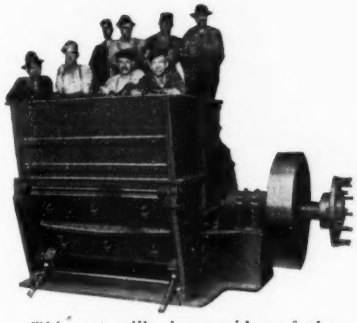
LICENSEES:

The Miles Co.—Salem, Ore.
Eugene Concrete Co.—Eugene, Ore.
Wastenburg Brick Co.—Klamath Falls, Ore
Arizona Shope Concrete Brick Co.—Phoenix, Ariz.
Florida Nu-Tex Brick Co.—109 Water St., Tampa, Fla.
Texas Shope Brick Co.—3056 Sumpter Bldg., Dallas, Tex.
Birmingham Slag Co.—Birmingham, Ala.
Shope Brick Co. of Wisconsin—50th and State Sts., Milwaukee, Wis.
The Polychrome Cement Brick & Tile Co.—Carter-Cotton Bldg., Vancouver, B. C.
Dark Canyon Stone Co., H. W. Jones, Mgr., Rapid City, S. D.
Warren Sand & Gravel Co.—Easton, Pa.
Penn Shope Brick Co.—Reading, Pa.
Lycoming Shope Brick Co.—Williamsport, Pa.
Shope Brick Co.—Portland, Ore.
Rustic Brick & Supply Co., Palette Rd., Ford City, Ont., Can.
Puyallup Shope Brick Co.—Puyallup, Wash.
The Shope Brick Co.—Springfield, Mass.
Utah Shope Brick Co., P. O. Box 632, Salt Lake City, Utah
Decoration Brick Co.—1565 N. Lake Ave., Seattle, Wash.

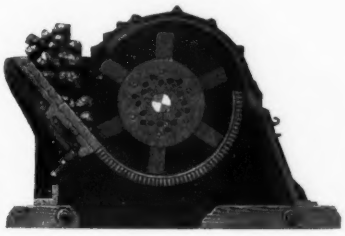
These licensees are all successful manufacturers

36 in. Limestone to 20 Mesh

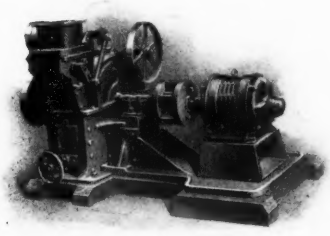
In Fewer Operations—Less Cost



This cut will give an idea of the receiving capacity of the Mammoth Crusher.



This illustrates the working parts of the Williams Crusher, which embodies the original hinged hammer principle. Why not let the originator of this principle adapt it to any grinding task you may have?



This shows the UNIVERSAL Williams Mill, direct-connected to motor. Get a free circular describing the complete installation.

The Mammoth—36 in. cubes to 1½ in. and finer—one operation

THE Williams Mammoth Crusher takes the place of two or three crushers, besides elevators, screens and other equipment. In a No. 9, the hinged hammers deliver 18,000 thirty-three ton blows per minute. Adjustment of grates and hammers regulates size of finished product, also percentage of "Fines." Built in capacities from 60 to 300 tons per hour. San Antonio Portland Cement Company, San Antonio, Texas, crushing 36" limestone, say, "Well pleased with Williams Mammoth Crusher." John Herzog & Sons Lime Company, Forest, Ohio, state, "Crushing 36" cubes to 1½" for macadam, by changing hammers and grates we crush to 12" and 6" for lime making less fines than we did on Jaw Crusher."

The Jumbo—18 in. or two-man stone to 1½ in. and finer

It takes the product of the largest Jaw Crushers and breaks it to 1½" and finer in one operation. Riverside Portland Cement Company, Riverside, Calif., says, "Not excelled by any type of crushing equipment." Western States Portland Cement Company, Independence, Kans., says: "Very satisfactory results obtained with this equipment." Monarch Portland Cement Company, Humboldt, Kans., have operated a Williams Jumbo Crusher for 5 years with practically no repair expense. The Jumbo in each of these plants follows the largest size Jaw Crusher. Also widely used to crush 12" lime to ⅛". Luckey Lime & Supply Co., Kelly Island Lime & Transport Co., and many other prominent firms listed among users.

The Universal Fine Grinder—Takes 1½ in. to 3 in. stone

Over 300 in operation in cement plants reducing 1½" to 2" limestone to 95% 20 mesh and 50% 100 mesh as tube mill feed. Universal Portland Cement Co., using 30 twenty-ton per hour units. Especially adapted to 20, 30, 40 Mesh and finer grinding, producing this fineness without outside separation. Widely used to pulverize clay, kaolin, fullers earth and similar material, and for reducing 1½" lime to 80% 100 Mesh.

Agricultural Limestone Crushers

There is a type and size of crusher suitable for every job, for the individual farm, for co-operative lime associations, for small and large manufacturers. State the quantity and type of product you want to produce, and we will show you how satisfactorily the Williams Hammer Principle will do the work. No charge for preliminary plans if they are desired.

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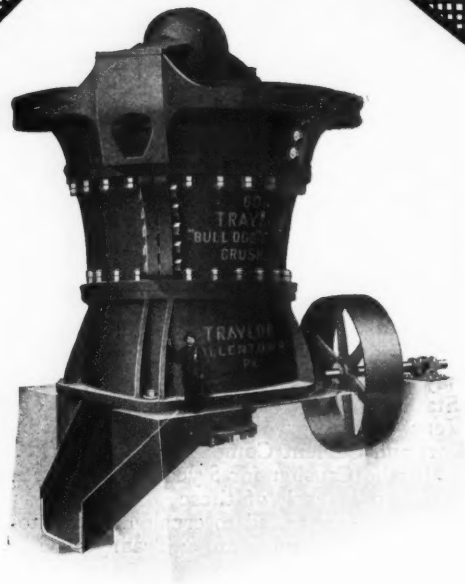
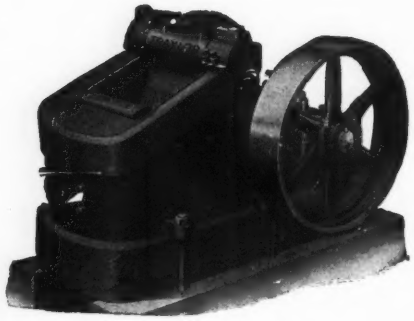
Williams

Patent Crushers – Grinders – Shredders

TRAYLOR
"Bulldog" Crushers





The Traylor "Bulldog" crushers are big brutes. There is power built into each machine, a ruggedness that can be depended on to stretch out into days and weeks and months of flawless service.

The force feed lubricating system, the bend proof shaft, cut steel gears that run in oil, the self-aligning eccentric journal in the "Bulldog" gyratories, and the frictionless toggle system and stronger but lighter self-aligning pitman mean a greater output for less power—they are new elements of value and worthy of your most serious consideration when you need a crusher.

Bulletins RGX-1 and RJX-1 fully illustrate and describe the "Bulldog" crushers. They're yours for a post-card.

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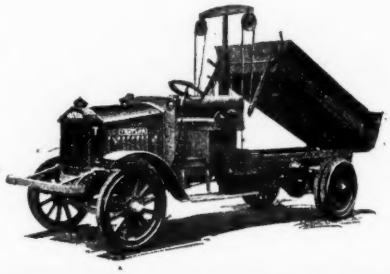
Like the "Bulldog" crushers—these trucks are built right—

They come in complete units ready for service—send for complete data.



Traylor Engineering & Manufacturing Co.

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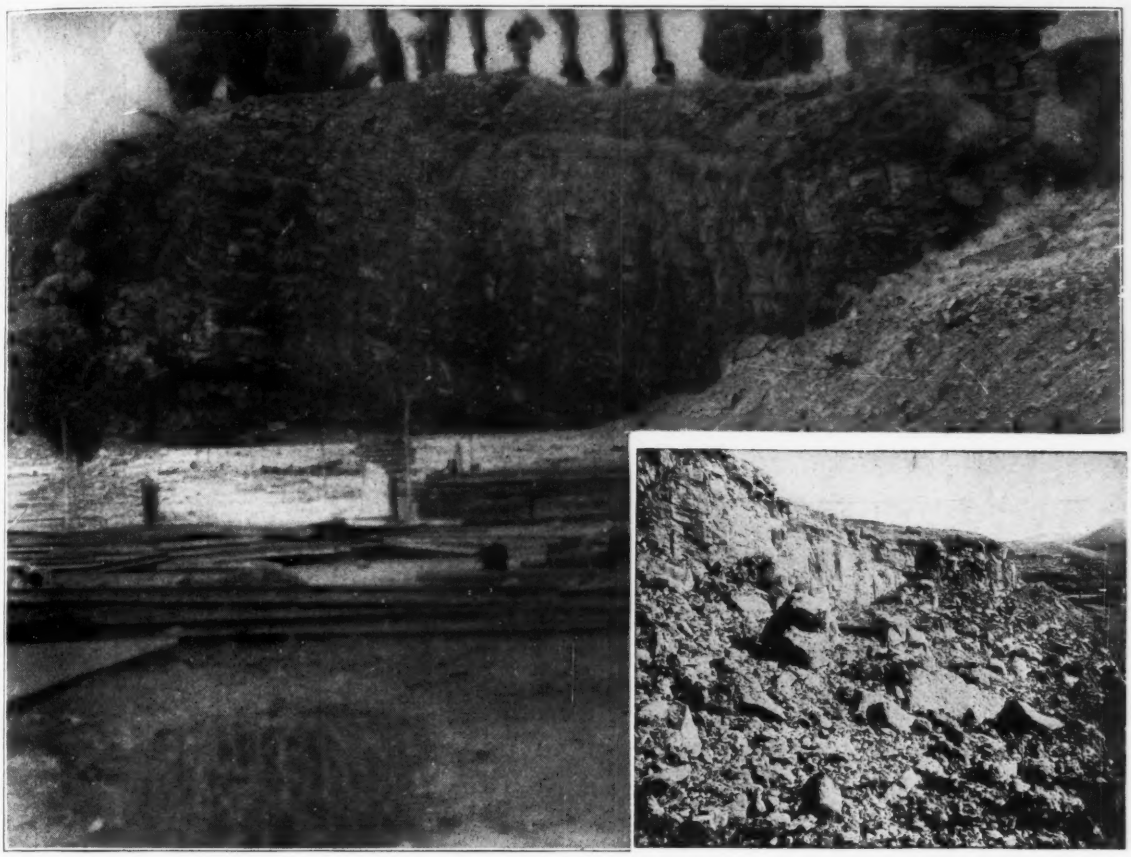
Truck and Tractor Division, **Cornwells, Bucks Co., Pa.**



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CORDEAU-BICKFORD Detonating Fuse is particularly adapted to well-drill blasting and the tunnel and pocket method of blasting where large quantities of explosives are to be detonated.

This method of detonation makes the operating of a quarry safer and decreases blasting cost. Cordeau-Bickford is run from the top to the bottom of the drill hole in continuous contact with the explosive charge. RESULTS: Complete detonation, quicker detonation, greater shattering effect, lower blasting costs.

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ESTABLISHED 1836 **ORIGINAL MAKERS OF SAFETY FUSE**

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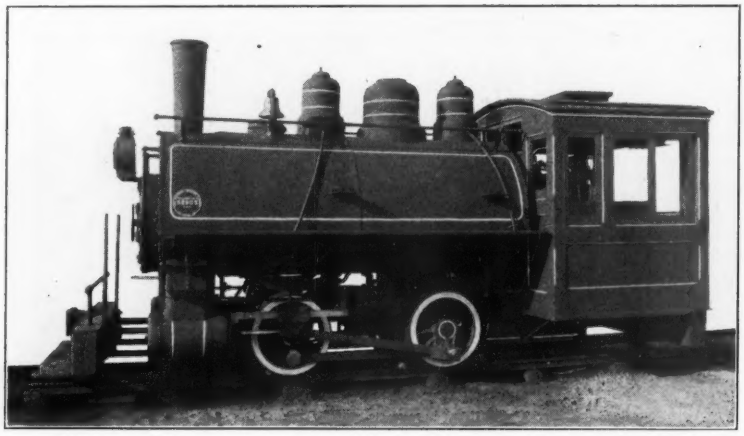

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Gauge, 3′ 0″
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Drivers, diameter, 29″
Tank Capacity, 700 gals.
Total Weight, 37,000 lbs.

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Gauge, 4′ 8½″
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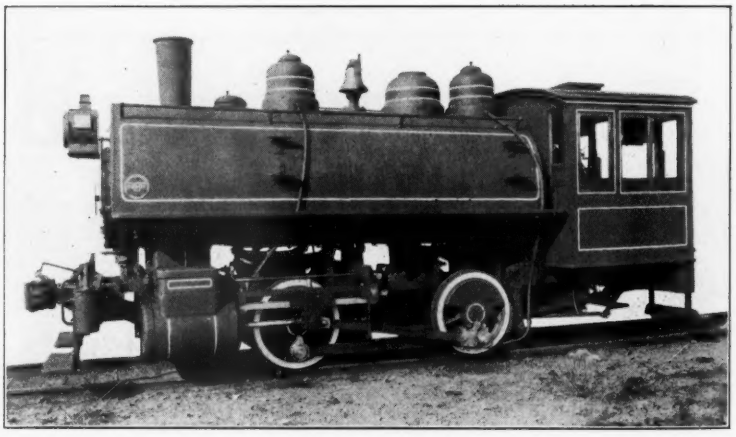

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LOCOMOTIVES

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For further facts, write for our pamphlet, describing the advantages and uses of Dragline Cableway Excavators in connection with modern gravel plants.

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1140 Monadnock Bldg., Chicago

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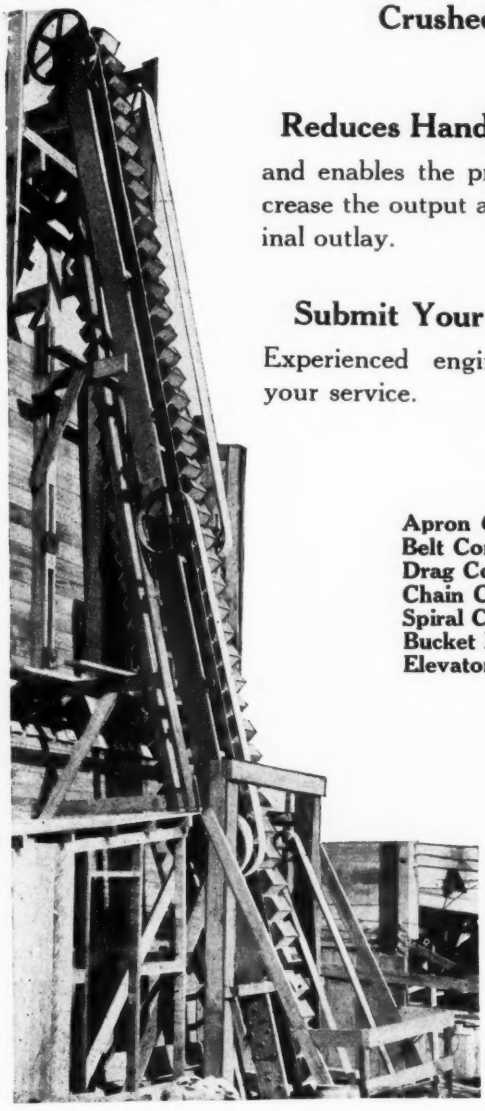
DRAGLINE CABLEWAY EXCAVATORS

WELLER

Conveying Machinery

For Handling

Cement, Coal, Fertilizer, Gravel, Gypsum, Lime, Phosphate, Sand, Crushed Stone, Etc.



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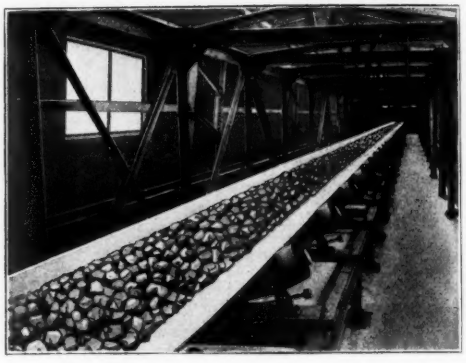

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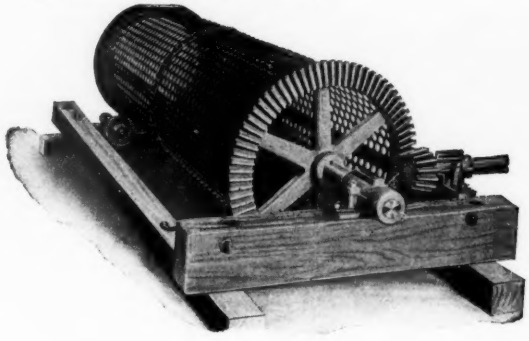

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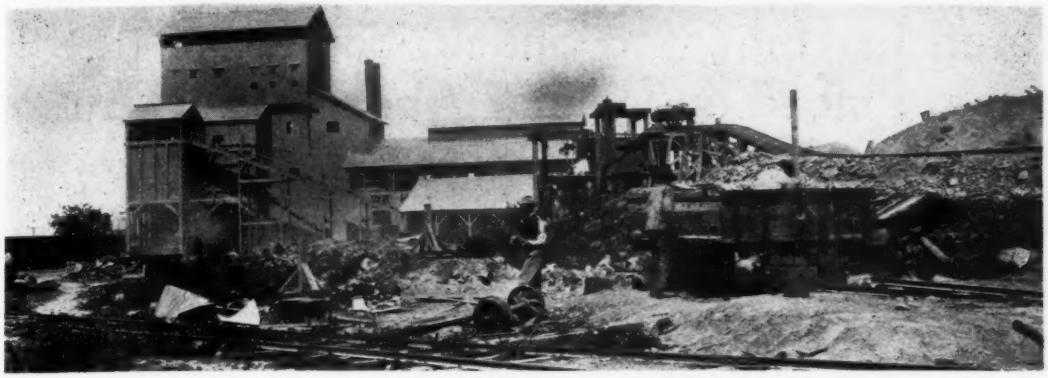

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ALL STEEL PATENTED

No rock is too hard for the Buchanan "All-Steel" Crusher—and they are built in a wide range of sizes. There is a Buchanan "All-Steel" Crusher that will exactly meet your requirements.

The Frame, Pitman, Swing Jaw and Toggles are of open-hearth steel, having a tensile strength of 60,000 to 65,000 lbs. per square inch, and thoroughly annealed to remove all internal shrinkage strains. All parts are accurately machined and carefully assembled and of high grade workmanship throughout. They stand the test of time and severe service.

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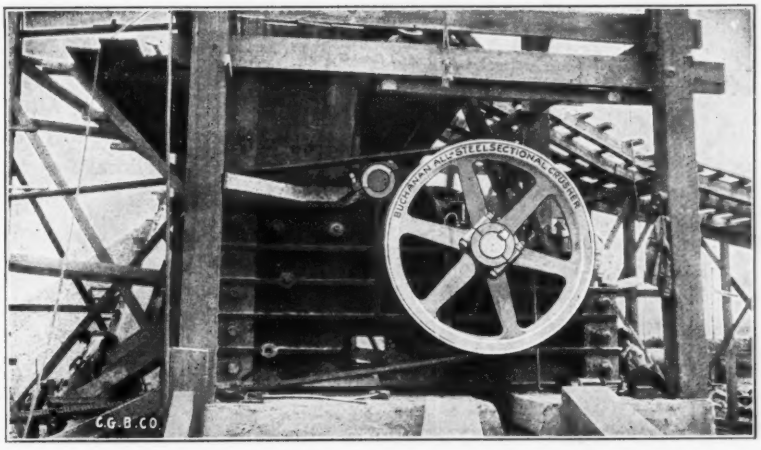

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"This dynamite gave us most satisfactory results in our work."

(*Excerpt from letter received from a user*)

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EXPLOSIVES ~ SERVICE

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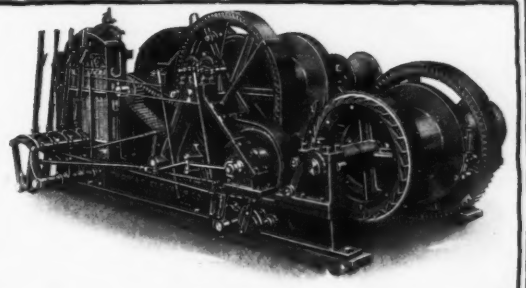
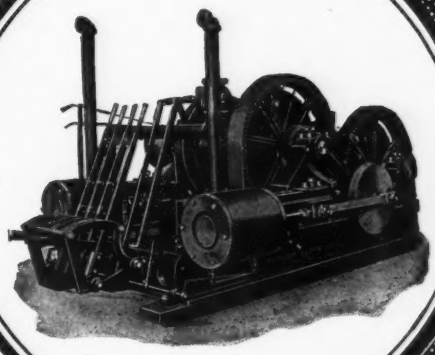
Steam, Electric, Single *and* Two Speed Types.





The true economy of Thomas' Hoists comes from their ability to stay right—to continue to give high tonnage for the very least in repairs, overhauling and cost of operation.

No casual inspection will ever disclose all of the Thomas quality—it is only those who have used Thomas Hoists for years that can appreciate how much genuine service and satisfaction is built into these Hoists.

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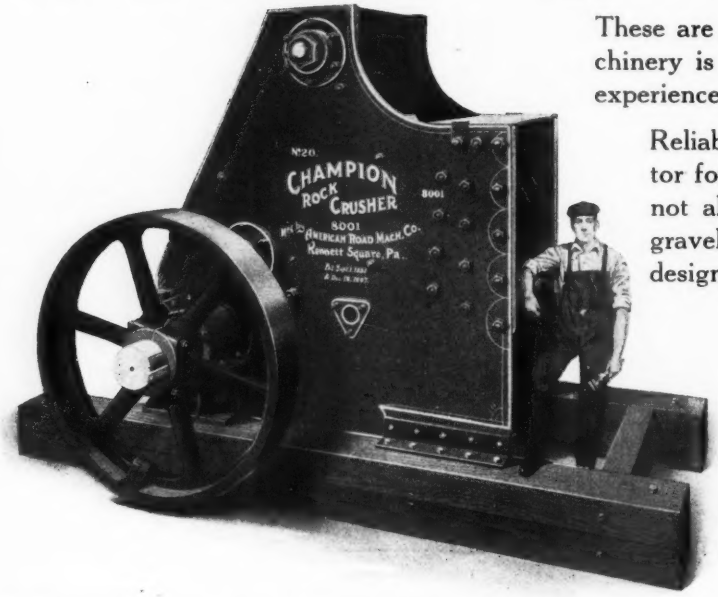

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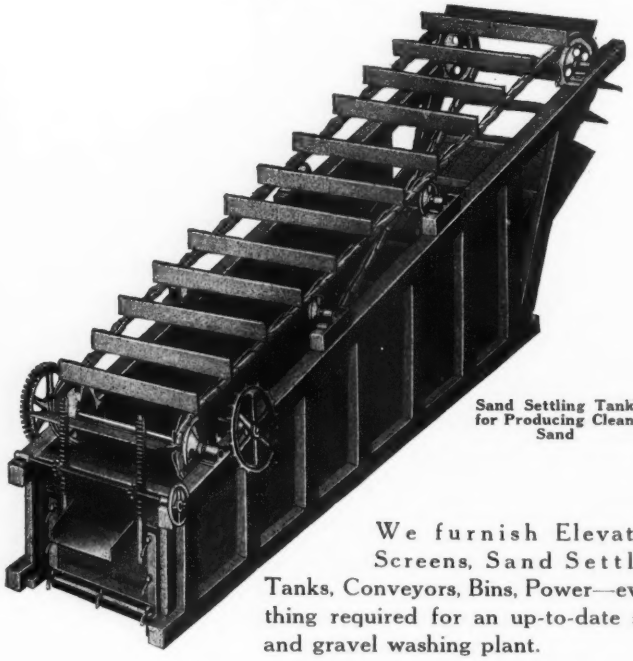

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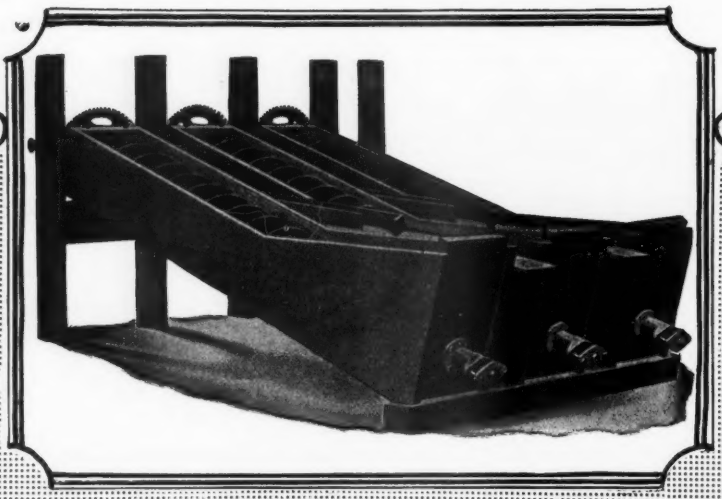

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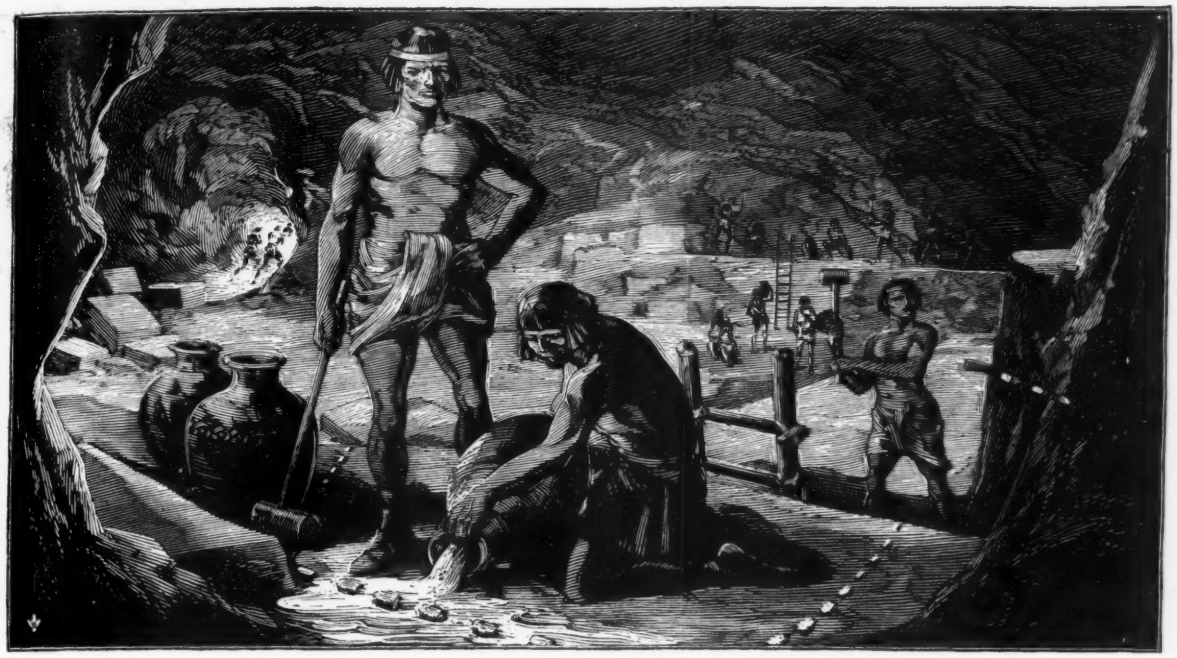
The Lewistown Equipment, which includes Crushing, Grinding, Screening, Washing, Drying and Conveying Machinery will produce more and a better quality of glass sand, at a bigger profit than any other equipment on the market.

These machines are sturdily constructed, giving consistent lasting service. They can be quickly installed, are compact and reasonably priced. Simple in construction and efficient in operation. There is more Lewistown Machinery used in the preparation of glass sand in this country than all other makes combined.

You will find that the Lewistown equipment and service will solve your glass sand producing problems.

Complete information furnished on request

Lewistown Foundry & Machine Company, Lewistown, Pa.



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Eighty thousand workmen with the quarrying tools of antiquity toiled in the subterranean quarries from which King Solomon obtained the pure white stone for his Temple—begun in 983 B. C.

Channels, to mark the dimensions of the blocks, were grooved in the rock wall with picks, crudely fashioned of bronze. The Egyptian method of breaking out the rock was used: into a niche cut in the stone, a dry wooden wedge was pounded and water poured in upon it. The swelling of the wood forced out the block.

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At a recent blast in a Wisconsin quarry more than 250,000 tons of rock were obtained with the aid of 32,200 pounds of Hercules Dynamite, or about 8 tons of stone for each pound of explosive.

King Solomon's craftsmen labored for many days, at a cost that would paralyze modern industry, to accomplish what one pound of Hercules Dynamite will now do for you in a moment.

But far as your costs are below those of King Solomon, you may be able to reduce them more. If interested, write to our Advertising Department, 951 King Street, Wilmington, Delaware, for a booklet entitled, "Volume vs. Weight".

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